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GENERAL

Atomic Bombs and Warfare

5803 AECU-3639

Sandia Corp., Albuquerque, N. Mex.

AN APPLICATION OF GAME THEORY TO SPECIAL WEAPONS EVALUATION. J. K. Hale and H. H. Wicke. Feb. 19, 1957. 10p. Contract [AT(29-1)-789]. $1.80 (ph OTS); $1.80 (mf OTS).

A method was introduced for combining the techniques of classical Lanchester theory of combat with those of game theory toward the end of selecting optimal strategies in combat with special weapons. In the application of this method to the example in which only the defender had atomic weapons, it was shown that the attacker always chose either to disperse his troops the maximum amount or not to disperse his troops at all. The defender always chose to employ a mixed strategy consisting of the weapon systems of either two intermediate weapons or four small weapons. If both the defender and attacker had access to atomic weapons, then the optimal strategy for the attacker was to employ the weapon system consisting of four small weapons and to use a mixed strategy for the dispersion of his troops. On the other hand, the defender never dispersed his troops and always used a mixed strategy for the weapon systems. In the example where the defender has a fixed weapon system and chooses to optimize his aiming procedure, it was shown that the optimal aiming procedure does not involve only the aiming procedures which are optimal against each of the fixed dispersion patterns for the attacker. The model discussed in this paper is far from realistic, but the authors feel that certain interesting trends may be obtained by such elementary discussions. Two ways in which to approach more realism are to introduce into the combat the time at which the different groups become engaged and to obtain a more realistic model for the basic group. (auth)

5804 UCRL-5124

California. Univ., Livermore. Radiation Lab.

THE UNDERGROUND NUCLEAR DETONATION OF SEPTEMBER 19, 1957, RAINIER—OPERATION PLUMBBOB. Gerald W. Johnson, Gene T. Pelsor, Roger G. Preston, and Charles E. Violet. Feb. 4, 1958. 27p. Contract W-7405-eng-48. Dep.; $0.75(OTS).

A nuclear device with an energy release of 1.7 kilotons was fired in a tunnel under a mountain at the Nevada Test Site on Sept. 19, 1957. The objective of the test was to develop a weapon testing technique which would eliminate fall-out; be independent of weather; and have no offsite effects such as noise, flash, and shock. The principal questions of the general feasibility were concerned with the required depth of overburden required for containment of the radioactivity, the magnitude of the induced ground motions and their associated effects on local and offsite structures, and the possibility of ground water contamination. A preliminary survey following the detonation indicated practically all of the radioactivity as well as the heat was contained in a region with a radius of about 60-ft, the seismic effects were negligible, and the fission products appeared to be trapped in highly insoluble fused silica so that the likelihood of ground water contamination is believed to be zero. Data collected following post-shot drilling are summarized. (C.H.)

Atomic Power

5805

NUCLEAR POWER FUTURE. C. G. Manly (U. S. Atomic Energy Commission, Washington). Chem. Eng. 65, No. 5, 133-8(1958) Mar. 10.

An evaluation is made of the future of commercial nuclear power. The conclusion is that not before 1965 will nuclear electric power be competitive. (J.S.R.)

5806

SHIPS: GAS-COOLED REACTOR IS THE CHOICE. Christopher Hinton (Central Electricity Generating Board) and R. V. Moore (U. K. Atomic Energy Authority). Nuclear Power 3, 11-16(1958) Jan.

The construction of a nuclear power ship by Great Britain necessitates the choice of reactor type. A review of the economic factors and other problems leads to the conclusion that a gas-cooled reactor of the Calder Hall type is the most feasible. (J.S.R.)

5807

WORLD SURVEY. Nuclear Eng. 3, No. 23, 62-5(1958) Feb.

Brief details of atomic energy developments in some 60 countries are presented with addresses of state authorities, principal officials and organizations, and notes on reactors commissioned and in course of construction. (auth)

5808

TECHNICAL LITERATURE OF 1957. A CLASSIFIED GUIDE FOR RAPID REFERENCE TO THE PRINCIPAL ARTICLES OF THE YEAR. Nuclear Eng. 3, No. 23, 70-7(1958) Feb.

The technical literature of 1957 on nuclear power development and reactor engineering is reviewed. In addition to published literature, selections from the monthly lists of unclassified documents printed by the U.K.A.E.A. are given. (J.E.D.)

BIOLOGY AND MEDICINE

5809
THEORY OF RADIOACTIVE POISONING BY MILITARY ATOMIC TESTS. K. Bechert. Atomkern-Energie 3, 64-8 (1958) Feb. (In German)

The poisoning which occurs during the continuation of atomic tests is distinguished from that occurring later. The earth and body poisoning and the quantity of radiation causing poisoning of critical organs are calculated. The calculation is simplified by the assumption that during the tests the fall-out is continuous. With unlimited continuation of atomic tests, earth and body poisoning approach a stable limiting value, which depends on the amount of the fall-out. After discontinuance of the tests, the earth and body poisoning first rises to its highest value and then sinks. Application of the equations to the question of Sr^{90} poisoning gives complete authorization for warnings about continuation of atomic tests. (J.S.R.)

5810
COLLAGEN REACTIVITY WITH METALS. Rubin Borasky (General Electric Co., Richland, Wash.). J. Am. Leather Chemists Assoc. 52, 596-610(1957) Nov.

5811
THE BIOLOGIC RESPONSE TO OVERPRESSURE. I. EFFECTS ON DOGS OF FIVE TO TEN-SECOND DURATION OVERPRESSURES HAVING VARIOUS TIMES OF PRESSURE RISE. Donald R. Richmond, Mead B. Wetherbe, Rinaldo V. Taborelli, Thomas L. Chiffelle, and Clayton S. White (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.). J. Aviation Med. 28, 447-60(1957) Oct.

Radiation Effects

5812 AECU-3413
New York. State Agricultural Experiment Station, Geneva. THE INDUCTION AND TESTING OF SOMATIC MUTATIONS IN APPLES, GRAPES AND OTHER ECONOMIC PLANTS. Progress Report for the Period February 1, 1956 to January 31, 1957. Charlotte Pratt and John Einset. 10p. Project No. 42. Contract AT(30-1)-1541. $1.80(ph OTS); $1.80(mf OTS).

Preliminary data are presented from observations on the response of three varieties of apples and one variety of grapes subjected to a wide range of radiation damage at growth stages ranging from seed to mature plants. Ultimate objectives of the study are the radioinduced production of mutations in apples and grapes. (C.H.)

5813
EFFECTS OF X-RAYS AND TRYPAN BLUE ON RETICULOENDOTHELIAL CELLS. N. R. Di Luzio, K. A. Simon, and A. C. Upton (Oak Ridge National Lab., Tenn.). Am. Med. Assoc. Arch. Pathol. 64, 649-56(1957) Dec.

5814
THE BIOLOGICAL EFFECTS OF MICROWAVE RADIATION ON AIR FORCE PERSONNEL. George M. Knauf (Griffiss Air Force Base, N. Y.). Arch. Ind. Health 17, 48-52(1958) Jan.

5815
BRONCHOGENIC CARCINOMA FROM RADIOACTIVE BARIUM SULFATE. H. Cember and J. A. Watson (Univ. of Pittsburgh). Arch. Ind. Health 17, 230-5(1958) Mar.

Sixteen rats survived an exposure regimen involving weekly intratracheal insufflations of 375 μc S^{35} in the form of 1.45μ diameter BaS_4O particles. Of this group, two rats showed severe squamous metaplasia in the lungs; one animal had an area in the bronchus that is thought to be either premalignant dysplasia or carcinoma in situ, and two rats had extensive bronchogenic squamous-cell carcinomas. Since the insufflated dose corresponds to an atmospheric concentration only 900 times the recommended maximum permissible concentration, it is suggested that a more conservative value be considered for continuous exposure to S^{35}. (auth)

5816
TOXICITY OF AUTOXIDIZED SQUALENE AND LINOLEIC ACID, AND OF SIMPLER PEROXIDES, IN RELATION TO TOXICITY OF RADIATION. V. J. Horgan, J. St L. Philpot, Barbara W. Porter, and D. B. Roodyn (A.E.R.E., Harwell, Didcot, Berks). Biochem. J. (London) 67, 551-9 (1957) Dec.

5817
RADIATION IN THE PRODUCTION OF USEFUL MUTATIONS. Harold H. Smith (Brookhaven National Lab., Upton, N. Y.). Botan. Rev. 24, 1-24(1958) Jan.

Applications of radiation in the production of genetic variants in plants are reviewed. Fundamental processes of gene mutation and chromosome breakage are discussed. The economic feasibility of employing radiation in plant improvement programs is considered. 90 references. (C.H.)

5818
EFFECTS OF DEUTERATION ON THE GROWTH OF PENICILLIUM NOTATUM AND ASPERGILLUS FONSECAEUS. Robert L. Shaffer, Henry L. Crespi, and Joseph J. Katz (Univ. of Chicago, Ill. and Argonne National Lab., Lemont, Ill.). Botn. Gaz. 119, 24-30(1957) Sept.

Differences are reported in the growth rate and morphology of Penicillium notatum and Aspergillus fonsecaeus grow in glucose-containing media containing various concentrations of deuterium. (C.H.)

5819
ASPECTS OF RADIATION DAMAGE LIKELY TO BE INVOLVED IN TUMOUR REGRESSION. I. RADIATION DAMAGE TO INDIVIDUAL CELLS. J. Read (Univ. of Otago, Dunedin, New Zealand). Brit. J. Radiol. 31, 68-5 (1958) Feb.

The various processes involved in the regression of a tumor subjected to radiotherapy are divided into the direct effects on cells and the indirect (constitutional) effects. Only the direct effects are considered here. Experiments in radiation biology are surveyed, and by inference and analogy it is concluded that the most important direct action of the radiation is the production of chromosome damage, which leads either to the death of cells or the loss of their capacity to continue division. (auth)

5820
ASPECTS OF RADIATION DAMAGE LIKELY TO BE INVOLVED IN TUMOUR REGRESSION. II. RADIATION DAMAGE TO CELLS DEPENDENT ON THEIR TISSUE ENVIRONMENT. Herman B. Chase (Brown Univ., Providence, R. I. and Mount Vernon Hospital, Northwood, Eng.). Brit. J. Radiol. 31, 65-9(1958) Feb.

The details of self-regulatory, homeostatic mechanisms are not generally fully known at present, but the existence of such mechanisms in biological systems is undoubted. This paper suggests that such mechanisms, especially those involving normal negative feedbacks and inhibitor levels, be recognized for the skin as one of the factors in radiation damage and repair and in tumor incidence and regression. (auth)

5821
IS STERILIZATION OF SEWAGE BY IRRADIATION ECONOMICAL? David L. Narver, Jr. (Hyperion Engrs., Los Angeles). Civil Eng. 27, 54-5(1957 Sept.

5822
BREPHOPLASTIC GRAFT OF THE SPLEEN ON THE KIDNEY CAPSULE OF THE NORMAL AND IRRADIATED MOUSE. Raoul-Michel May and Marie-Jeanne Thillard. Compt. rend. 246, 990-2(1958) Feb. 10. (In French)

A method was devised to determine the beneficial effects of spleen tissue against irradiation in mice. Two mice, of the same line, were irradiated under 70 kv and 3 mamp for times varying from 15 min for 950 r to 16 min for 1000 r. Immediately after irradiation, one of the two mice received spleen from a new-born mouse grafted under the kidney capsule. The study shows that for radiation doses of 900 and 948 r the spleen tissue offers little protection, the percentage of survival being 65% for the controls and 68% for the grafted mice. For radiation doses of 1000 r the percentage of deaths in the first week was 43.5% for the controls and 34% for the grafted mice. The percentage of survival after the fourth week was 52% for the grafted mice and 37.5% for the controls. In mice having a splenectomy before the brephoplastic graft, the spleen tissue does not seem to have any beneficial effect. (J.S.R.)

5823
EFFECTS OF BLOCKING INTRACELLULAR STRUCTURES ON THE RADIO RESISTANCE OF CELLS. M. N. Meisel, N. A. Pomoshchnikova, and T. S. Sokolova (Inst. of Microbiology, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk. S.S.S.R. 117, 143-5(1957) Nov. 1. (In Russian)

5824
COMPARISON OF THE X-RAY SENSITIVITY OF BACTERIAL SPORES. C. R. Woese (Yale Univ., New Haven, Conn.). J. Bacteriol. 75, 5-8(1958) Jan.

5825
IONIZING RADIATION AND THE AGING PROCESS. A. C. Upton (Oak Ridge National Lab., Tenn.). J. Gerontol. 12, 306-13(1957) July.

5826
THE COURSE OF EXPERIMENTAL LEPTOSPIROSIS IN IRRADIATED ANIMALS. R. V. Petrov. J. Microbiol. Epideminol. Immunobiol. (U.S.S.R.) (English Translation) 28, 478-83(1957).

5827
RADIATION HAZARDS IN THE FIELD OF PEDIATRICS. Meinhard Robinow (Yellow Springs Clinic, Ohio) and Frederic N. Silverman (Univ. of Cincinnati Coll. of Medicine). Pediatrics 20, No. 5, 921-40(1957) Nov.

5828
EFFECT OF SALTS OF HEAVY METALS ON THE RADIOSENSITIVITY OF TRANSPLANTABLE TUMOURS. I. V. Veselaia and V. I. Gorodyskii (Kiev Radiological and Oncological Research Inst.). Problems Oncology 3, 303-5 (1957).

5829
RECESSIVE LETHAL MUTATION INDUCED IN THE MOUSE BY CHRONIC γ-IRRADIATION. T. C. Carter (Medical Research Council's Radiobiological Research Unit, Harwell, Berkshire, Eng.). Proc. Roy. Soc. (London) B147, 402-11(1957) Dec.

5830
RECOVERY FROM X-RAY-INDUCED SENSITIVITY TO HEAT IN AN INSECT. W. F. Baldwin (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Radiation Research 8, 17-21(1958) Jan.

5831
EFFECTS OF ROENTGEN IRRADIATION ON THE TUMOR BED. III. THE DIFFERENT INHIBITING ACTION ON THE GROWTH OF MOUSE MAMMARY CARCINOMA RESULTING FROM PRE- OR POSTTRANSPLANTATION IRRADIATION. H. Vermund, K. W. Stenstrom, D. C. Mosser, and M. K. Loken (Univ. of Minnesota Medical School, Minneapolis). Radiation Research 8, 22-31(1958) Jan.

5832
THE EFFECT OF TOTAL-BODY X-IRRADIATION ON THE ADULT AXOLOTL (SIREDON MEXICANUM). V. V. Brunst (Roswell Park Memorial Inst., Buffalo, N. Y.). Radiation Research 8, 32-45(1958) Jan.

5833
INDEPENDENT INACTIVATION OF BACTERIOPHAGE T1 BY X-RAYS AND ULTRAVIOLET LIGHT. Ruth F. Hill (Columbia Univ., New York). Radiation Research 8, 46-50 (1958) Jan.

5834
RADIOSENSITIVITY OF BACILLUS THERMOACIDURANS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS. Bernard E. Proctor, Samuel A. Goldblith, George J. Fuld, and E. Marilyn Oberle (Massachusetts Inst. of Tech., Cambridge). Radiation Research 8, 51-63(1958) Jan.

5835
RELATIVE EFFECTIVENESS OF NEUTRONS FOR PRODUCTION OF DELAYED BIOLOGICAL EFFECTS. I. EFFECT OF SINGLE DOSES OF THERMAL NEUTRONS ON LIFE SPAN OF MICE. John B. Storer and Phyllis C. Sanders (Los Alamos Scientific Lab., N. Mex.). Radiation Research 8, 64-70(1958) Jan.

White Swiss mice were exposed to single, graded doses of x rays of thermal column radiation (thermal neutrons plus gamma rays) and allowed to live their life span. Mean life span was calculated for each group, and per cent life shortening as a function of dose was determined. Under the conditions of the experiment, life shortening amounted to about 5% per 100 rads for either type of radiation. The relative biological effectiveness (RBE) of thermal column radiation for shortening life span was 1.00 ± 0.24, a value not significantly different from the RBE for the production of 30-day death. (auth)

5836
RELATIVE EFFECTIVENESS OF NEUTRONS FOR PRODUCTION OF DELAYED BIOLOGICAL EFFECTS. II. EFFECT OF SINGLE DOSES OF NEUTRONS FROM AN ATOMIC WEAPON ON LIFE SPAN OF MICE. John B. Storer, B. S. Rogers, I. U. Boone, and P. S. Harris (Los Alamos Scientific Lab., N. Mex.). Radiation Research 8, 71-6(1958) Jan.

Mice were exposed to neutrons or to mixtures of neutrons and γ-rays from an atomic detonation and allowed to live out their life span. It was found that neutrons shortened the mean life span by 6.7% per 100 rads, and it was estimated that γ rays shortened the life span by 2.6% per 100 rads. The relative effectiveness of neutrons for production of this delayed response was 2.6, a value in close agreement with those previously obtained for production of acute effects. (auth)

5837
THE EFFECT OF IONIZING RADIATION ON THE CAPACITY OF BACTERIA TO SUSTAIN PHAGE GROWTH. Ernest Pollard, Jane Setlow, and Erica Watts (Yale Univ., New Haven, Conn.). Radiation Research 8, 77-91(1958) Jan.

5838
CHANGES IN THE CENTRAL NERVOUS SYSTEM AFTER 700 R TOTAL-BODY X-IRRADIATION. W. O. Caster, E. S. Redgate, and W. D. Armstrong (Univ. of Minnesota, Minneapolis). Radiation Research 8, 92-7(1958) Jan.

Subsequent to 700 r total-body x irradiation there are significant physiological and chemical alterations in the

central nervous system of the rat. At 3 to 12 hours after irradiation there are significant decreases in brain DNA and in both high- and low-frequency activity in the electrocorticogram. Within the next 2 to 3 days all these measures return to or exceed normal levels, and there are changes in the concentrations of water and electrolyte in the brain. In the 4- to 10-day period both brain DNA and the low-frequency activity with electrocorticogram are below control levels. Except for a rise at 10 days, the high-frequency activity is normal throughout this period. In general, the low-frequency electrocorticographic activity parallels changes in brain DNA. Increases in high-frequency activity occur at times coinciding with the acute and LD_{50} death periods. (auth)

5839

BACTERIOLOGICAL STUDIES ON MICE EXPOSED TO SUPRALETHAL DOSES OF IONIZING RADIATIONS. II. FAST NEUTRON AND X-RADIATION FROM LABORATORY SOURCES. Myron S. Silverman, Vivian Greenman, Paul H. Chin, and Victor P. Bond (U. S. Naval Radiological Defense Lab., San Francisco). Radiation Research 8, 123-30(1958) Feb.

Infection with one or more species of endogenous enteric bacteria was found to occur in a high percentage of mice after exposure to supralethal doses of neutron radiation (510 rads) or x radiation (1340 rads), doses which result in death within 5 days probably from gastrointestinal injury. The incidence of infection paralleled the increase in deaths. During the first 60 hours bacteria were isolated primarily from the spleen. After that time a bacteremia developed. The administration of 10 mg of streptomycin and 4000 units of penicillin drastically decreased the incidence of infection but did not alter either the per cent of deaths or the mean survival time of the neutron-irradiated mice, although the mean survival time of the x-irradiated mice was lengthened somewhat. Hence, it must be concluded that postirradiation infection plays only a minor role, if any, as a cause of death after exposure to these doses of ionizing radiation. (auth)

5840

RADIATION STUDIES ON THE INFECTIVE PROPERTY OF NEWCASTLE DISEASE VIRUS. Dwight Wilson and Ernest Pollard (Yale Univ., New Haven, Conn.). Radiation Research 8, 131-41(1958) Feb.

The inactivation of the infective property in Newcastle disease virus (NDV) has been studied with fast charged particles and slow electrons. The results of proton, deuteron, and α-particle bombardment of NDV indicate that the total radius of the virus is at least 510 A, and that the virus possesses a spherical radiation-sensitive region 280 A in radius. The results of slow electron bombardment of NDV show that the radiation-sensitive region is surrounded by a radiation-insensitive coat 230 A thick. (auth)

5841

RADIATION STUDIES ON THE HEMOLYSIN OF NEWCASTLE DISEASE VIRUS. Dwight Wilson (Yale Univ., New Haven, Conn.). Radiation Research 8, 142-9(1958) Feb.

Ionizing radiation studies on the Newcastle disease virus hemolysin indicate that this property resides in about fifteen independent targets. If we assume that these hemolysin molecules are flat plates, they will be 100 to 140 A in radius and 20 A thick. Fifteen molecules of this dimension arranged on the virus surface would cover 15 to 30% of the total surface area. (auth)

5842

RADIOBIOLOGIC OBSERVATIONS ON CANCER PATIENTS TREATED WITH WHOLE-BODY X-IRRADIATION. Lowell S. Miller, Gilbert H. Fletcher, and Herbert B. Gerstner (M. D. Anderson Hospital and Tumor Inst., Houston, Texas and Randolph Air Force Base, Texas). Radiation Research 8, 150-65(1958) Feb.

A series of 263 cancer patients received whole-body irradiation with doses ranging from 15 to 200 r. Critical evaluation of the procedure as a therapeutic tool was excluded from the report; its scope was limited essentially to acute and subacute effects, so far as they were systematic in nature. These effects—predominantly nausea, vomiting, and bone marrow depression—were practically absent below 100 r; they became noticeable between 125 and 175 r; and they developed into complications requiring clinical treatment in 10% of the patients at 200 r. (auth)

5843

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF FISSION NEUTRONS FOR THE PRODUCTION OF ACUTE MORTALITY IN MICE. Nicholas Delihas and Howard J. Curtis (Brookhaven National Lab., Upton, N. Y.). Radiation Research 8, 166-80(1958) Feb.

An RBE of 1.7 of fission neutrons with respect to 250-kvp x rays to produce an LD_{50} in 30 days in CF_1 female mice was determined. The x-ray LD_{50} dose was 636 rads, and the neutron dose was 366 rads. Tissue-equivalent ionization chambers were employed to measure the neutron dose. (auth)

5844

DOES THERE EXIST MUTATIONAL ADAPTATION TO CHRONIC IRRADIATION? K. G. Lüning and Sten Jonsson (Univ. of Stockholm, Sweden). Radiation Research 8, 181-4 (1958) Feb.

This study has been concerned with possible mutational adaptation due to incorporation in the population of mutational isoalleles with lower mutability than the alleles originally present. A comparison has been made between the rates of recessive lethals and y, w, and sn mutations induced by x rays in males from Drosophila melanogaster stocks kept at normal background radiation versus those under constant γ-irradiation (5 r/hr). No difference in the mutability was found between these two stocks, and hence there are no indications of a mutational adaptation due to mutational isoalleles. These negative results do not exclude a possible mutational adaptation, or recovery phenomenon, which is discussed. (auth)

5845

CHRONIC RADIATION MORTALITY IN MICE AFTER SINGLE WHOLE-BODY EXPOSURE TO 250-, 135-, AND 80-Kvp X-RAYS. Douglas Grahn and George A. Sacher (Argonne National Lab., Lemont, Ill.). Radiation Research 8, 187-94(1958) Feb.

Mice subjected to equal acute injury by exposure to 250-kvp, 135-kvp, or 80-kvp x rays show a uniform degree of chronic injury. Mean aftersurvival and tumor incidence are the same for all radiation qualities. Females demonstrate a greater sensitivity to chronic radiation injury than males. Reduction of life expectancy after dosages in the midlethal range averages 36.7% and 29.2% for females and males, respectively. In the x-ray energy range of 80 kvp to 250 kvp, the values for comparative effectiveness derived from acute $LD_{50(30)}$ air doses are concluded to be equally valid for measuring effectiveness in terms of chronic injury and mortality after single-dose whole-body exposure. (auth)

5846

STAGES OF DEATH OF X-RAY-INDUCED EMBRYO LETHALS IN HAPLOIDS AND IN HETEROZYGOTES OF HABROBRACON. Anna R. Whiting, Sarah Caspari, Melpomeni Koukides, and Priscilla Kao (Univ. of Pennsylvania, Philadelphia). Radiation Research 8, 195-202(1958) Feb.

This study demonstrates that, for x-ray-induced embryo lethals, dominants in haploids, dominants in heterozygotes, and recessives in haploids kill at increasingly later stages, respectively; and haploid embryos with more than one recessive lethal respond differently in respect to mean stages at death depending on whether the lethals were induced by x-irradiation of oöcytes or of spermatozoa. In oöcytes x-ray-induced lethality appears to be due to recessive lethals sensu stricto, and there is no correlation between number of lethals present in an embryo and its stage at death, no cumulative effect. In spermatozoa evidence suggests induction of translocations and inversions in addition to true recessive lethals. The significant positive correlation between numbers of lethals and stages at death may be due to these additional factors. (auth)

1947

EFFECT OF RADIATION OF HUMAN HEREDITY. Geneva, World Health Organization, 1957. 168p. $4.00.

A report is given by the World Health Organization (WHO) Study Group on the effects of radiation on human heredity. The opinions presented are from authorities on genetics from countries other than those whose national committees have already stated their views. Opinions of experts on the aspects of research which should be followed to increase the understanding of genetic effects of ionizing radiation on man are discussed. In addition, papers are presented by various members on the damage from point mutations in relation to radiation dose and biological conditions, types of mutation at known gene loci, and possibility of hitherto unrecognized mutations being induced. Papers on problems accompanying an increase of mutation rates in Mendelian populations, detection of induced mutations in offspring of irradiated parents, and gonad doses from diagnostic and therapeutic radiology are presented, as well as papers on problems in the estimation of spontaneous mutation rates in animals and man, effects of inbreeding levels of populations on incidence of hereditary traits due to induced recessive mutations, and detection of genetic trends in public health. (R.V.J.)

1948

THE EFFECTS OF ATOMIC RADIATION ON OCEANOGRAPHY AND FISHERIES. Publication No. 551. Washington, National Academy of Sciences—National Research Council, 1957. 142p.

General Considerations Concerning The Ocean As A Receptacle for Artificially Radioactive Materials. An attempt was made to summarize both the present knowledge and the areas of ignorance concerning the oceans that must be taken into account in considering the biological effects of radiation. Physical and Chemical Properties of Wastes Produced by Atomic Power Industry. The range of physical and radiochemical characteristics that may be anticipated in concentrated fuel reprocessing wastes and approximate quantities of wastes produced are indicated. Comparison of Some Natural Radiations Received by Selected Organisms. The accumulation of natural radiations from various sources for man and fish for different levels in both air and water is described. Disposal of Radioactive Wastes in the Ocean: The Fission Product Spectrum in the Sea as a Function of Time and Mixing Characteristics. An attempt was made to construct a detailed quantitative picture of the fission product spectrum in the ocean, in steady state with a given fission rate. Transport and Dispersal of Radioactive Elements in the Sea. The physical processes whereby radioactive elements in true solution are diluted by mixing and are carried from one part of the ocean to another are described. The Effects of the Ecological System on the Transport of Radioactive Elements in the Sea. The processes which must be considered in order to evaluate biological effects on the ultimate distribution of radioisotope wastes or contaminants in the sea are described. Precipitation of Fission Product Elements on the Ocean Bottom by Physical, Chemical, and Biological Processes. An attempt is made to define the processes by which materials may be carried to the bottom, to note the conditions under which these several processes can be expected to operate, and to assess the extent to which the processes have been responsible for the removal of activity to the bottom in cases where bottom accumulation has been measured. Ecological Factors Involved in the Uptake, Accumulation, and Loss of Radionuclides by Aquatic Organisms. Some experiments are described on the uptake, accumulation, and loss of radionuclides by various marine organisms. Accumulation and Retention of Radioactivity from Fission Products and Other Radiomaterials by Fresh-Water Organisms. These organisms include many biological forms such as vascular plants, algae and phytoplankton, protozoans, zooplankton and other invertebral forms, and representatives of each of the five vertibrate classes. Effects of Radiation on Aquatic Organisms. The relative sensitivity of different groups of aquatic organisms to the effects of radiation is discussed. Isotopic Tracer Techniques for Measurement of Physical Processes in the Sea and the Atmosphere. The present status of our knowledge of the distribution and properties of various naturally occurring isotopes which are useful for studies of atmospheric and oceanic transfer phenomena are discussed. On the Tagging of Water Masses for the Study of Physical Processes in the Oceans. Consideration has been given some of the problems involved in tagging water masses in the open ocean. Large-Scale Biological Experiments Using Radioactive Tracers. (W.L.H.)

Radiation Hazards and Protection

5849 UWFL-50

Washington. Univ., Seattle. Applied Fisheries Lab. LAND CRABS AND RADIOACTIVE FALLOUT AT ENIWETOK ATOLL. Edward E. Held. May 27, 1957. 39p. Contract AT(45-1)540. $1.25(OTS).

The pattern of changing levels of radioactivity is given for the tissues of land hermit crabs, Coenobita perlatus, from Belle Island, Eniwetok Atoll, during a period of nearly two years following the 1954 series of atomic tests. $Sr^{90} + Y^{90}$, and Cs^{137} were the principal long-lived fission products found. Sr^{90} levels in the skeleton remained constant throughout the period of study. (auth)

5850 WT-1172

California. Univ., Los Angeles. Atomic Energy Project. EVALUATION OF THE ACUTE INHALATION HAZARD FROM RADIOACTIVE FALL-OUT MATERIALS BY ANALYSIS OF RESULTS FROM FIELD OPERATIONS AND CONTROLLED INHALATION STUDIES IN THE LABORATORY. G. V. Taplin, O. M. Meredith, Jr., and H. Kade. June 1957. 26p. Project 37.3 [of] OPERATION TEAPOT. $0.75(OTS).

An evaluation of the acute inhalation hazard from radioactive fall-out materials has been made by analysis of results from animal exposures during field operations and from controlled inhalation studies in the laboratory. Rabbits and rats have been subjected to controlled inhalation exposures to dusts prepared by micropulverizing fused insoluble radioactive siliceous material obtained from Area 3 at the Nevada Test Site, Operation Upshot-Knothole. In these laboratory studies, field conditions were simulated in respect to duration of exposure, particle-size distribu-

tion, and levels of air-borne radioactivity involved. The relation between particle size, dust concentration, and duration of exposures to initial deposition in the lungs and gastrointestinal tract has been determined. In addition, the rates of removal have been measured. The laboratory studies demonstrate two important physiological-safety factors against the retention of dangerous quantities of inhaled particulate materials. These are, first, the filtration mechanism of the upper respiratory passages which limits pulmonary retention to particles of small size (below 5.0 μ), and, second, the normal clearance mechanisms of the upper and lower lung passages which remove initially deposited large and small particles at rapid rates. The results from exposing several groups of rabbits to fall-out material (by inhalation only) at stations located along two arcs, 7 and 106 miles from a tower detonation, are almost entirely negative. Urine specimens obtained during the first day following detonation contained minute but measurable amounts of soluble radioactive material which had a relatively short half life (1 to 2 days). Lung specimens had no detectable radioactivity when measured 60 to 21 days later; however, samples of intestine from the same animals still had measurable levels of beta activity. The total integrated internal radiation exposure could be expressed in millirep, even at the close stations, where the integrated external gamma-ray exposure was found to be 14 to 32 r. At the 106-mile stations, no measurable radioactivity was present in specimens of lung or urine; however, the levels of radioactivity in intestine samples were either negative or several times lower than those found in animals at the near stations. The external gamma-ray dose was less than 4.0 r. From careful consideration of numerous pertinent physical and physiological factors and from analysis of field and laboratory investigations, it is evident that there is no apparent situation in nuclear warfare where, during the first few days after the detonation, one could inhale sufficient radioactive material to induce a serious radiation injury to lungs or intestines without simultaneously being subjected to supralethal doses of external beta-gamma radiation. (auth)

5851
RADIATION HYGIENE ABOARD NUCLEAR SUBMARINES. John H. Ebersole. Am. Ind. Hyg. Assoc. Quart. 18, 305-11(1957) Dec.

5852
PRE-OPERATIONAL ENVIRONMENTAL SURVEY FOR A POWER REACTOR. G. Hoyt Whipple (Univ. of Rochester, N. Y.). Am. Ind. Hyg. Assoc. Quart. 18, 315-18(1957) Dec.

5853
DIFFUSION AND DEPOSITION IN RELATION TO REACTOR SAFETY PROBLEMS. Maynard E. Smith and Irving A. Singer (Brookhaven National Lab., Upton, N. Y.). Am. Ind. Hyg. Assoc. Quart. 18, 319-30(1957) Dec.

5854
HOMOLOGOUS BONE MARROW IN THE TREATMENT OF RADIATION INJURY IN MICE. C. C. Congdon and Irene S. Urso (Oak Ridge National Lab., Tenn.). Am. J. Pathol. 33, 749-67(1957).

5855
NEW YORK'S EXPERIENCE IN ADMINISTERING CODE ON RADIATION PROTECTION. Morris Kleinfeld. Arch. Ind. Health 17, 87-95(1958) Feb.

5856
EXPERIMENTAL TREATMENT OF TOTAL-BODY IRRADIATION INJURY: A BRIEF REVIEW. C. C. Congdon (Oak Ridge National Lab., Tenn.). Blood 12, 746-54(1957) Aug.

5857
EFFECT OF PRE-IRRADIATION INTRAPERITONEAL INJECTION OF CYSTEAMINE UPON THE SKIN AND DEPILATORY REACTIONS PRODUCED BY X RAYS IN THE LEGS OF MICE. C. W. Wilson (Westminster Hospital, London). Brit. J. Radiol. 31, 100-1(1958) Feb.

Cysteamine injected intraperitoneally before irradiation was found to afford protection against the skin and depilatory effects produced by 2000 r of 200 kv x rays given locally to the legs of mice. (auth)

5858
THE RADIOPROTECTIVE CAPACITY OF GASEOUS HYDROGEN. Jean-Michel Kirrmann. Compt. rend. 245, 2413-14(1957) Dec. 16. (In French)

Hydrogen gas protects the frontal bone of the chicken embryo against a localized x irradiation producing abnormalities in the controls. (tr-auth)

5859
BONE MARROW TRANSPLANTATION IN ANIMALS EXPOSED TO WHOLE-BODY RADIATION. C. C. Congdon (Oak Ridge National Lab., Tenn.). J. Cellular Comp. Physiol. 50, Suppl. 1, 103-8(1957) Dec.

5860
INDUSTRIAL HEALTH IN THE ATOMIC ENERGY INDUSTRY. James H. Sterner (Eastman Kodak Co., Rochester, N. Y.). Minerva Nucleare 1, 213-16(1957) Oct.

5861
THE PUBLIC HEALTH IMPLICATIONS OF THE ATOMIC AGE. Clinton C. Powell (U. S. Dept. of Health, Education, and Welfare, Washington). Minerva Nucleare 1, 217-19 (1957) Oct.

5862
THE EFFECT OF HYPOTHERMIA ON THE RADIOSENSITIVITY OF MICE TO WHOLE-BODY X-IRRADIATION. Shirley Hornsey (Hammersmith Hospital, London). Proc. Roy. Soc. (London) B147, 547-9(1957) Dec. 17.

5863
AFTER-EFFECTS OF IONIZING RADIATION IN BARLEY. II. MODIFICATION BY STORAGE OF X-IRRADIATED SEEDS IN DIFFERENT CONCENTRATIONS OF OXYGEN. Jack D. Adams and R. A. Nilan (State Coll. of Washington, Pullman). Radiation Research 8, 111-22(1958) Feb.

5864
BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY. NUMBER 9 FOR APRIL-JUNE, 1957. Tokyo, The Japan Meteorological Agency, 1957. 92p. (In English and Japanese)

Data are tabulated on the radioactivity in samples of rain water, airborne dusts, and air collected at various stations in Japan between April and June, 1957. (C.H.)

5865
CODE OF PRACTICE FOR THE PROTECTION OF PERSONS EXPOSED TO IONIZING RADIATIONS. PART A: USE OF X-RAYS FOR DIAGNOIS; USE OF X-RAYS AND γ-RAY BEAM UNITS FOR THERAPY. PART B: USE OF RADIOACTIVE ISOTOPES. SUPPLEMENT: PROTECTION AGAINST IONIZING RADIATIONS — FUNDAMENTAL DATA. London, Her Majesty's Stationary Office, 1957. 8s

Radiotherapy

5866
PITUITARY IRRADIATION WITH HIGH-ENERGY PROTON BEAMS. A PRELIMINARY REPORT. C. A. Tobias, J. H. Lawrence, J. L. Born, R. K. McCombs, J. E. Roberts, H. O. Anger, B. V. A. Low-Beer, and C. B. Huggins (Univ. of California, Berkeley). Cancer Research 18, 121-34(1958) Feb.

5867
HISTORICAL PROGRESS OF THE ISOTOPIC METHODOLOGY AND ITS INFLUENCES ON THE BIOLOGICAL SCIENCES. G. Hevesy. Minerva Nucleare 1, 189-200 (1957) Oct.

5868
MEDICAL RESEARCH AND CANCER THERAPY IN A MODERN RADIOISOTOPE HOSPITAL. Robert J. Hasterlik (Univ. of Chicago, Ill.). Minerva Nucleare 1, 208-13(1957) Oct.

Toxicology Studies

5869 AECU-3426
New York Univ. Bellevue Medical Center, New York. Inst. of Industrial Medicine.
IMMUNOCHEMICAL STUDIES ON BERYLLIUM. Progress Report to April 1957. Sidney Belman, Walter Troll, and Norton Nelson. 21p. Contract AT(30-1)-1664. $4.80 (ph OTS); $2.70(mf OTS).

The inflammatory skin disorder clinically observed in some Be workers demonstrates the characteristics of an allergic or sensitivity response, and the chronic form of pulmonary disease attributed to Be exposure exhibits characteristics of an allergic origin. An immunochemical study of Be was undertaken to study these phenomena. Preliminary results are presented from studies on binding of Be using a cation exchange resin, the induction of a Be specific anaphylaxis in guinea pigs by injection of a Be-epidermal homogenate, and an investigation of Be binding by the soluble constituents of epidermis. (C.H.)

5870 AERE-Med/M-21
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
NOTES ON THE TOXICOLOGY OF DIBROMETHANE AND TETRABROMETHANE. Frances M. Turner. Nov. 1957. 6p.

Tracer Applications

5871 AECU-3412
Washington. Univ., Seattle.
BIOLOGICAL CYCLES OF FISSION PRODUCTS IN AQUATIC SYSTEMS AS STUDIED AT THE PACIFIC ATOLLS OF BIKINI AND ENIWETOK. Lauren R. Donaldson. [1954?]. 8p. $1.80(ph OTS); $1.80(mf OTS).

The ecology of the Pacific Atolls of Bikini and Eniwetok is described. Results are summarized from studies on the distribution of fission products in the biota. The contributions of these studies to a better understanding of life zones of coral atolls, the economy of the sea, and fundamental concepts of biological sciences are discussed. (C.H.)

5872 NP-tr-45
BIOSYNTHESIS OF NICOTINE LABELLED WITH C^{14}, AND PROCESSES OF TRANSMETHYLATION IN TOBACCO LEAVES. A. M. Kuzin and V. I. Merenova. Translated by V. Beak from Doklady Akad. Nauk S.S.S.R. 85, 393-5 (1952). 6p.

5873
A CLASSIFIED BIBLIOGRAPHY ON THE APPLICATION OF ISOTOPES IN PURE AND APPLIED RESEARCH. I. AGRICULTURE. Intern. J. Appl. Radiation and Isotopes 3, No. 1, 46-77(1958).

This bibliography includes references covering the period from 1955 through 1956 on applications of isotopes in pure and applied research in the field of agriculture. Topics covered include animal husbandry, entomology, photosynthesis, metabolite physiology in animals, plant physiology, fertilizer uptake by plants; non-metabolite physiology in animals; and general animal physiology. (C.H.)

5874
METABOLISM OF ADENINE IN MICE. Edward L. Bennett and Hilda Karlsson (Univ. of California, Berkeley). J. Biol. Chem. 229, 39-50(1957) Nov.

5875
THE DISTRIBUTION OF RADIOISOTOPES OF SOME HEAVY METALS IN THE RAT. Patricia W. Durbin, Kenneth G. Scott, and Joseph G. Hamilton. Univ. of Calif. (Berkeley) Publ. Pharmacol. 3, No. 1, 1-34(1957). $0.75.

A summary is presented of data on the biological half times and the principal deposition sites of 18 heavy metals in rats. Tracer techniques were used in the studies. Data are included on the following elements: Cd, Hg, In, Tl, Sn, Pb, Nb, Ta, Mo, W, Tc, Re Ru, Os, Rh, Ir, Pd, and Pt. (C.H.)

CHEMISTRY

5876 AERE-Inf/Bib-116
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
MOLECULAR SIEVES. A Literature Survey. B. J. Wilson. Dec. 1957. 6p. $0.21(BSI).

To provide background information on a possible method of decontamination of air using molecular sieves, this report reviews briefly the properties of such sieves and describes the contents of three review articles and three other papers referring to the subject. Only general results are noted, but it is indicated in which papers the detailed data can be found. (auth)

5877 AERE-R/M-138
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME STUDIES OF THE REACTION BETWEEN SODIUM AND BISMUTH. R. I. Hawes. Sept. 1957. 13p.

In a circulating fuel, liquid metal fuelled reactor, a secondary liquid metal coolant circuit is likely to be used. There is interest in a solution of U in Bi as a fuel and Na as a secondary coolant. An exothermic reaction occurs between Na and Bi leading to a high melting point intermetallic compound. This paper discusses the effects which might occur if a leak occurred in the primary heat exchanger and reports some experiments which were carried out to investigate these effects. (auth)

5878 GAT-L-434
Goodyear Atomic Corp., Portsmouth, Ohio.
HYDROFLUORINATION OF FLUOROX PELLETS. Gordon A. Rampy. Dec. 26, 1957. 6p. Contract [AT(33-2)-1]. $1.80(ph OTS); $1.80(mf OTS).

In order to obtain data needed to express mathematically the hydrofluorination-reduction step of the Fluorox Process, the changes in surface area and physical dimensions of the pellets as a result of reaction were determined. Data were also obtained on the chemical changes taking place during hydrofluorination. (W.L.H.)

5879 ISC-504(Del.)
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN ENGINEERING FOR APRIL, MAY, JUNE 1954. July 31,

1954. Decl. with deletions Feb. 26, 1957. 11p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

5880 AEC-tr-3120

THE PREPARATION OF METALLIC SCANDIUM IN THE SOLID STATE. František Petru, Vladimír Procházka, and Bohumil Hájek. Translated from Chem. listy 51, 672-5(1957). 8p.

Metallic scandium has been prepared for the first time in the solid and pure state by the reduction of scandium chloride or scandium fluoride by calcium. This method makes possible the preparation of metallic scandium in large quantity. The modern methods of the high-frequency furnace were used for carrying out this reaction. The described method of preparing metallic scandium presents the possibility of determining for this metal the physical and chemical properties which are currently known for other metals. (auth)

5881

SOME COMPLEX COMBINATIONS OF TETRACHLORIDES OF ELEMENTS OF THE FOURTH GROUP. Roger Perrot and Claude Devin. Compt. rend. 246, 772-4(1958) Feb. 3. (In French)

The preparation and principal properties of the addition compounds obtained with nitrosyl chloride and with aryl-acetonitriles are discussed. The compounds $ZrCl_4 \cdot 2NOCl$ and $ThCl_4 \cdot 2NOCl$ are new, as are the complexes with the nitriles considered. (tr-auth)

5882

THE SOLUBILITY OF WATER VAPOR IN FUSED ALKALI NITRATE MIXTURES AND IN LITHIUM PERCHLORATE. Frederick R. Duke and Arthur S. Doan, Jr. (Iowa State Coll., Ames). Iowa State Coll. J. Sci. 32, 451-3(1958) Feb. 15.

It has long been recognized that certain salts dissolve unusual amounts of water. This work was undertaken to provide quantitative data on the solubility of water vapor in some fused salts as a function of pressure, temperature, and salt composition. (A.C.)

5883

METHOD OF BORON EVAPORATION. Akira Hashizume. J. Sci. Research Inst. (Tokyo) 51, 211-14(1957) Dec.

Using an electrically heated graphite crucible, a method of obtaining boron layer by evaporation is described in which the necessity of temperature control is stressed. About 0.1 mg/cm^2 of boron layer is obtained by one run of evaporation on an aluminum disc of 8 cm in diameter to be used as the ionization chamber electrode. (auth)

Analytical Procedures

5884 AERE-C/M-336

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF PLUTONIUM AS A MINOR CONSTITUENT IN ALLOYS WITH LEAD, TIN, AND BISMUTH. K. W. Brooke, D. H. F. Atkins, and E. N. Jenkins. Dec. 1957. 6p. $0.32(BIS).

Plutonium was determined by counting the alpha sources prepared by evaporating small aliquots of solutions prepared from binary alloys of Pu with Pb, Sn or Bi and of tertiary alloys of Pu and Bi with Pb or Sn. A Pu standard is used, of similar isotopic composition to the alloyed Pu. The results are accurate to ±2% (2 σ level) for samples containing > 0.04% w/w Pu; much lower levels can be determined but with some loss of precision. (auth)

5885 AERE-C/R-2307 (Rpt: UNCLASSIFIED)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ANALYSIS OF THORIUM–BORON AND URANIUM-BORON ALLOYS. G. A. Barnett and G. W. C. Milner. Dec. 1957. 15p. $0.45(BSI).

Procedures are described for the analysis of binary alloys of Th–B and U–B. Although Th can be determined in the presence of B by direct titration with EDTA (ethylene diamine tetra-acetic acid) using xylenol orange as indicator, it is necessary to separate B before determination by the mannito-boric acid titration procedure. This separation is suitably effected by using the cation exchange resin Zeocarb 225. With U–B alloys, the U is determined by precipitation as ammonium diuranate followed by ignition to U_3O_8. The separation of B prior to determination is again accomplished by a procedure employing the ion exchange resin Zeocarb 225. (auth)

5886 AERE-C/R-2382

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE LANTHANUM FLUORIDE CO-PRECIPITATION METHOD FOR THE DETERMINATION OF PLUTONIUM; THE EFFICIENCY OF PRECIPITATION OF THE LANTHANUM CARRIER AS FLUORIDE. R. G. Monk. June 1950. Decl. Apr. 1957. 9p. $0.32(BSI).

Declassified version of AERE-C/R-496.

The efficiency of precipitation of LaF_3 in the co-precipitation method for determining Pu has been investigated using La^{140} as tracer. The procedure has been shown to precipitate more than 99.9% of the carrier La as fluoride. Omission of the period of standing results in a considerable proportion of La remaining unprecipitated but this may be offset by a suitable increase in the centrifuging time. A modified procedure is suggested in which the standing time is reduced from overnight to 1 to 2 hours and the centrifuging time increased from 2 to 5 minutes. (auth)

5887 AERE-C/R-2384

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF TRIBUTYL PHOSPHATE IN KEROSENE SOLUTIONS. A. J. Fudge and G. C. Hutton. 1957. Date of MS. May 1954. Decl. with amendment Apr. 1957. 18p. $0.54(BSI).

Declassified version of AERE-C/R-1308.

In order to meet the needs of the pilot plant process for the separation of U^{233} from irradiated Th, a rapid method was developed to check the purity of commercial tributyl phosphate and the composition of various mixtures of tributyl phosphate in odorless kerosene. The method takes one and a half hours, and a coefficient of variation of better than 2% has been attained. The tributyl phosphate is hydrolyzed by refluxing with 55% HI, the excess of which is destroyed with HNO_3. The butyl iodide and the iodine are then removed, and the phosphate in the residue determined colorimetrically as phosphovanadomolybdate. (auth)

5888 NP-tr-39

THE HIGH FREQUENCY TITRATION IN ANALYTICAL CHEMISTRY. Kurt Cruse. Translated from Experientia, Suppl., No. 5, 107-33(1956). 20p.

5889 NP-tr-46

THE USE OF DISPLACEMENT REACTIONS OF CHEMICAL COMPLEXES IN POLAROGRAPHIC ANALYSIS. H. Flaschka, S. Khalofolla, and F. Sadek. Translated by E. Wait from Z. anal. Chem. 156, 169-79(1957). 26p.

5890

DETERMINATION OF Sr^{89} AND Ba^{140} IN BONE DAIRY PRODUCTS, VEGETATION, AND SOIL. H. L. Volchok

and J. E. Gaetjen (Isotopes, Inc., Westwood, N. J.) and J. L. Kulp and W. R. Eckelmann (Lamont Geological Observatory, Palisades, N. Y.). Ann. N. Y. Acad. Sci. 71, 293-304(1957) Aug. 28.

5891

ACCUMULATION OF DIETARY BORON AND STRONTIUM IN YOUNG AND ADULT ALBINO RATS. R. M. Forbes and H. H. Mitchell (Univ. of Illinois, Urbana). Arch. Ind. Health 16, 489-92(1957) Dec.

5892

RADIOCHEMICAL ANALYSIS OF STRONTIUM AND BARIUM IN HUMAN URINE. L. B. Farabee (Oak Ridge National Lab., Tenn.). Arch. Ind. Health 17, 200-3(1958) Mar.

A radiochemical method is described for the determination of minute amounts of radioactive Sr and Ba in samples containing large amounts of Ca and Mn. The procedure will be useful for analyzing either urine or bone samples. Procedures for the analysis of human urine samples for Sr^{90} content are described in detail. (C.H.)

Crystallography and Crystal Structure

5893 KAPL-1883

Knolls Atomic Power Lab., Schenectady, N. Y.

THE STRUCTURE AND OPTICAL PROPERTIES OF $CaO \cdot 2Al_2O_3$ AND $SrO \cdot 2Al_2O_3$. E. R. Boyko and L. G. Wisnyi. July 1, 1957. 17p. Contract W-31-109-Eng-52. $0.75(OTS).

The apparent paradox of a compound, $CaO \cdot 2Al_2O_3$, which appears uniaxial while giving a monoclinic x-ray diffraction pattern is resolved. The final crystal structure shows the Al atoms in a tetrahedral configuration. In the network of the tetrahedra, one O atom is found to be linked to three Al atoms as might be expected from the 7:4 O to Al ratio. The isomorphic compounds $CaO \cdot 2Al_2O_3$ and $SrO \cdot 2Al_2O_3$ are biaxial positive and biaxial negative, respectively. (auth)

Deuterium and Deuterium Compounds

5894

STUDY OF THE BINARY EQUILIBRIUM BETWEEN HYDROGEN AND ITS ISOTOPES. Robert Trevino Arizpe (Instituto Nacional de la Investigación Cientifica). Rev. mex. fis. 4, 23-34(1955). (In Spanish)

The procedure followed for drawing the equilibrium curves of the binary mixtures: $H_2 - HD$ and $H_2 - D_2$, starting with the differential equations of equilibrium, is reported. These curves show the physical possibility of separation of the system $H_2 - D_2$ by fractional distillation. However, the low concentration of D_2 in natural hydrogen necessitates orienting the treatment to the solution $H_2 - HD$. In the last process, using a catalytic reactor, the D_2 content can be enriched, and finally, D_2O obtained in a phase of oxidation. (tr-auth)

5895

HD REACTOR (1) THERMODYNAMIC PROPERTIES OF THE REACTION $H_2 + D_2 \rightleftharpoons 2HD$. Jóse Raúl Carrasco R. (Instituto Nacional de la Investigación Científica). Rev. mex. fis. 4, 35-51(1955). (In Spanish)

Some thermodynamic properties are calculated for the reaction $H_2 + D_2 \rightleftharpoons 2HD$. This information is needed for the design of a reactor capable of decomposing HD efficiently and obtaining D_2, which is the primary objective of this investigation. (tr-auth)

Fluorine and Fluorine Compounds

5896

HIGH-CAPACITY, LONG-LIFE FLUORINE CELL. S. P. Vavalides, R. E. Cable, W. K. Henderson, and C. A. Powell (Union Carbide Nuclear Co., Paducah, Ky.). Ind. Eng. Chem. 50, 178-80(1958) Feb.

Construction and operating details are presented for a new 32-anode fluorine cell. (W.L.H.)

5897

A 25-POUND-PER-HOUR FLUORINE PLANT. Joe Dykstra, B. H. Thompson, and W. C. Paris (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Ind. Eng. Chem. 50, 181-6(1958) Feb.

The operation and the components of the 25-pound-per-hour fluorine plant at the Oak Ridge Gaseous Diffusion Plant are described. (W.L.H.)

5898

THE ANOMALOUS BEHAVIOR OF FLUOROCARBON SOLUTIONS. Robert L. Scott (Univ. of California, Los Angeles). J. Phys. Chem. 62, 136-45(1958) Feb.

Existing data on 64 fluorocarbon solutions (vapor pressures, solubilities, heats of mixing and volume changes) are summarized, and the free energies deduced are compared in a consistent way with the predictions of Hildebrand's solubility parameter theory. Many solutions, notably fluorocarbon–hydrocarbon mixtures, show very much larger positive deviations from ideal behavior than can be accounted for by the difference of "thermodynamic" solubility parameters. However, other solutions (e.g., C_7F_{16} with CCl_4 and with I_2) are entirely normal. Various explanations of this anomalous behavior are reviewed and criticized: (1) the interpenetration of hydrocarbon molecules, (2) an empirical shift in δ for hydrocarbons, (3) volume changes, (4) corresponding states theories, (5) polarity of C–F bonds, (6) differences in ionization potential, and (7) non-central force fields. Of these, only the last two appear promising and they do not account for the behavior of all of the anomalous systems. Additional experimental and theoretical studies are needed; some directions for future research are suggested. (auth)

5899

ON THE MAGNETIC STRUCTURE OF THE FLUORIDES OF TRANSITION METALS. I. Dzyaloshinskii (Inst. of Problems in Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1454-6(1957) Dec. (In Russian)

Investigations were made of the magnetic structure of antiferromagnetic crystals of MnF_2, CoF_2, FeF_2, and NiF_2. It is shown that crystals of such symmetry may possess weak ferromagnetism. (tr-auth)

Graphite

5900

THE REACTION OF IODINE BROMIDE WITH GRAPHITE. Gérard Colin and Albert Hérold. Compt. rend. 245, 2294-5 (1957) Dec. 15. (In French)

The vapor emitted by iodine bromide is fixed on natural graphite to give, according to the temperature, the compound $C_8I_xBr_y$ (with $x + y = 1$) or products poorer in the halogens. Artificial graphite fixes less Br and I than the

natural graphite. In all the cases, the titer in iodine x/(x + y) of the final product approaches 45%. (J.S.R.)

Laboratories and Equipment

5901 AERE-C/R-2148

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

DEVELOPMENT OF A REMOTELY OPERATED VACUUM INDUCTION FURNACE. G. M. Gillies and B. A. J. Lister. July 1957. 21p.

This report describes the development of a vacuum induction furnace for the melting and bottom-pour casting of uranium by remote operation on a scale up to 5 kg. (auth)

5902 Y-1188

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

PORTABLE MERCURY VAPOR DETECTOR. C. S. McMurray and J. W. Redmond. Jan. 7, 1958. 45p. Contract W-7405-eng-26. $1.25(OTS).

A description is given of a functional mercury vapor detector which is a portable, self-contained, survey instrument, and has a minimum range from zero to two-tenths milligram of mercury per cubic meter of air. (auth)

Molecular Structure

5903

VISUALIZATION OF INDIVIDUAL LIPOPROTEIN MACROMOLECULES IN THE ELECTRON MICROSCOPE. Thomas L. Hayes and John E. Hewitt (Univ. of California, Berkeley). J. Appl. Physiol. 11, 425-8(1957) Nov.

Visualization of individual serum lipoprotein molecules has been accomplished using the electron microscope. A description of the ultracentrifugal and electron microscopic technique is given as well as data on molecular dimensions. (auth)

Radiation Chemistry

5904 AECU-3625

Wisconsin. Univ., Madison.

CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS AND THEIR USE IN MAKING LABELED COMPOUNDS. J. B. Evans, J. E. Quinlan, and J. E. Willard. [1957]. 24p. Contract [AT(11-1)-32]. $4.80(ph OTS); $2.70(mf OTS).

The chemical effects of nuclear transformations can be utilized to introduce the radioactive atoms produced into chemical species useful for tracer studies. Gas chromatography offers a means of separating the tagged compounds with high specific activity. A chromatographic apparatus for separating and identifying labeled compounds is described. Comparisons are made of this with other labeling techniques. (auth)

5905 AERE-C/R-1575(1 to 6)Suppl. 1

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

SELECTED ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORT LITERATURE IN THE FIELD OF RADIATION CHEMISTRY And BIBLIOGRAPHY OF THE PUBLISHED LITERATURE. First Annual Supplement (Papers noted up to February 1957). R. W. Clarke, comp. Mar. 1957. 212p. $5.04(BSI).

5906

TRIBUTYL PHOSPHATE AND ITS DILUENT SYSTEMS. L. L. Burger and E. D. McClanahan (Hanford Atomic Products Operation, General Electric Co., Richland, Wash.). Ind. Eng. Chem. 50, 153-6(1958) Feb.

This work is concerned with extending previous data and identifying the products of radiolysis for mixtures of tributyl phosphate in petroleum naphtha. (W.L.H.)

5907

CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS. J. B. Evans, J. E. Quinlan, and J. E. Willard (Univ. of Wisconsin, Madison). Ind. Eng. Chem. 50, 192-5(1958) Feb.

A detailed discussion is presented of the methods used in labeling chemical compounds. (W.L.H.)

5908

USING ELECTRONS IN CHEMICAL PROCESSING. J. W. Ranftl (General Electric Co., Milwaukee, Wis.). Ind. Eng. Chem. 50, 196-8(1958) Feb.

The use of a linear accelerator for investigating the effects of ionizing radiations on chemical materials is described. (W.L.H.)

5909

RADIOLYSIS AND RADIOLYTIC OXIDATION OF LUBRICANTS. R. O. Bolt and J. G. Carroll (California Research Corp., Richmond). Ind. Eng. Chem. 50, 221-8(1958) Feb.

A survey of various organic classes and species which might be suitable for lubricant use is presented. Included was a study of the relative stabilities of organic fluids, effects of additives on these, and effects of irradiation variables. (W.L.H.)

5910

RADIOLYSIS OF NEOPENTANE AND CYCLOHEXANE BY Co^{60} γ-RADIATION: EFFECT OF TEMPERATURE. Motome Hamashima, M. P. Reddy, and Milton Burton (Univ. of Notre Dame, Ind.). J. Phys. Chem. 62, 246-7 (1958) Feb.

The effects of temperature on the radiolysis products of neopentane and cyclohexane are described. The results show that temperature has an imperceptible effect on $G(H_2)$ from cyclohexane, although there may be a small effect on $G(CH_4)$. There appear to be distinct effects of temperature on both $G(H_2)$ and $G(CH_4)$ from neopentane. Possible mechanisms of radiolysis are discussed. (J.S.R.)

5911

STUDIES IN THE RADIOLYSIS OF FERROUS SULFATE SOLUTIONS. III. AIR-FREE SOLUTIONS AT HIGHER pH. Walter G. Rothschild and A. O. Allen (Brookhaven National Lab., Upton, N. Y.). Radiation Research 8, 101-10(1958) Feb.

Radiation oxidation of air-free ferrous sulfate solutions was studied at pH levels up to 2.1, and the results explained in terms of competitive reactions of H and OH for the various solute species present. The yield G_H of H atoms, obtained by γ-irradiation of water, has now been found as a function of pH over the range 0 to 5. Relative values of the specific rates for reaction of OH with H_2 and Fe^{II}, of H with Fe^{II}, Fe^{III}, and O_2, and of HO_2 with Fe^{II} and Fe^{III} are obtained at different pH's. Only those reaction rates involving Fe^{III} are affected by changing pH over the range 0.4 to 2.7. The oxidation of Fe^{II} by H atom appears to occur equally readily at pH 2.1 and 0.4, suggesting that the H atom in solution is practically completely complexed even at the higher pH in the form H_2^+. (auth)

Radiation Effects

5912 NARF-58-7T
Convair, Fort Worth, Tex.
EFFECTS OF MIXED-FIELD RADIATION ON AIRCRAFT FUELS. [PART] I. F. A. Haley. Feb. 3, 1958. 22p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-194).

Samples of two typical aircraft fuels, Mil-F-5572A and Mil-F-5624B, were irradiated in the mixed field of the Ground Test Reactor at Convair-Fort Worth in April 1956. The samples were subsequently subjected to various engineering tests to investigate the effects of radiation on fuels. Both fuels increased in existent gum sufficient to render their use unfeasible after prolonged exposure to an intense radiation field. The Mil-F-5572A fuel failed to meet the existent gum specification after exposure to an approximate dose of 2.5×10^9R of gamma radiation and 6.3×10^{12} nvt of fast neutrons. Although the Mil-F-5624B fuel exhibited fairly stable properties after moderate exposures to radiation, it also failed to meet specifications for existent gum after receiving an approximate dose of 5.0×10^8R of gamma radiation and 1.3×10^{14} nvt of fast neutrons. Some increase in substituted aromatics was observed by infrared spectrometry in the Mil-F-5572A fuel, and an increase in aldehydes (>C = 0) and aliphatic ketones ($-CH_2-CO-CH_2-$) was noted in the Mil-F-5624B fuel. (auth)

5913
RADIATION DAMAGE IN LUBRICATING GREASES. R. W. Hotten and J. G. Carroll (California Research Corp., Richmond). Ind. Eng. Chem. 50, 217-20(1958) Feb.

The colloidal structure of lubricating greases made with conventional soaps as gelling agents is severely damaged by gamma radiation. Both the initial softening and the final hardening may be reduced by using synthetic aromatic compounds in place of conventional gelling agents and oils. (W.L.H.)

5914
NOTE ON THERMAL EXPANSION OF NEUTRON-IRRADIATED SILICA. Ivan Simon (Arthur D. Little, Inc., Cambridge, Mass.). J. Am. Ceram. Soc. 41, 116 (1958) Mar.

The amorphous form of silica produced by irradiation of quartz to a total integrated flux of 1.4×10^{20} fast neutrons per cm^2 has a thermal expansion coefficient of 5.4×10^{-7} $deg.^{-1}$ between 25 and 200°C. (J.S.R.)

5915
ON THE EFFECT OF HIGH ENERGY RADIATION TO POLYMERS. I. CROSS-LINKING AND DEGRADATION. Osamu Saito (Chuo Univ., Tokyo). J. Phys. Soc. Japan 13, 198-206(1958) Feb.

Integro-differential equations are obtained which describe the variation of molecular weight distributions in a polymer substance caused by irradiation. The solutions of these equations give the gel point and the average molecular weights. In the case of cross-linking without cyclization, the results agree with those obtained by other authors. The problems involving cyclization and branching are also solved, showing that the gel formation is retarded by cyclization and that the weight average branching number diverges at the gel point, while the number average branching number does not. As for degradation, the molecular weight distributions for an arbitrary radiation dose are obtained, and it is shown that for any initial distribution the final molecular weight distribution becomes Poisson-like. The problem which deals with the case where cross-linking and degradation coexist is also discussed, and it is shown that for any initial distribution the gel formation occurs only when the ratio of the two probabilities concerning degradation and cross-linking is smaller than 4. (auth)

5916
ON THE MECHANISM OF RADIATION EFFECT ON DNA SYNTHESIS. L. G. Lajtha, R. Oliver, T. Kumatori, and F. Ellis (Radiobiology Lab., Oxford, Eng.). Radiation Research 8, 1-16(1958) Jan.

Rare Earths and Rare-earth Compounds

5917
THE SULFIDES AND OXYSULFIDES OF GADOLINIUM, DYSPROSIUM, AND ERBIUM. Jean Flahaut, Micheline Guittard, Jean Loriers, and Madeleine Patrie. Compt. rend. 245, 2291-3(1957) Dec. 16. (In French)

Sulfides of the type Me_2S_3 were prepared for Gd, Dy, and Er. The crystal parameters, densities, and melting points were determined. Dy and Gd polysulfides of the type MeS_2 were prepared, but it was impossible to obtain ErS_2. The crystal parameters and densities were determined. Dy_5S_7 and Er_5S_7 were prepared by heating Me_2S_3 with Al in a vacuum at 1300 to 1350°C for 4 hours. However the amount of S is slightly in excess of theory. The crystal parameters, and densities of these compounds were also determined. GdS was prepared, and its crystal structure and density were determined. The corresponding compounds of Dy and Er were impossible to prepare. (J.S.R.)

Separation Procedures

Refer also to abstracts 6365, 6366, and 6369.

5918 AERE-I/M-47
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A PALLADIUM COLUMN FOR CONCENTRATING TRITIUM FROM 2-LITRE MIXTURES OF TRITIUM AND HYDROGEN. J. Chadwick. Oct. 1957. 6p. $0.32(BIS).

The separation of Tritium from 2-liter batches of tritium and hydrogen containing varying amounts of tritium in the initial mixture by palladium chromatography is described. (auth)

5919 BNL-3203
Brookhaven National Lab., Upton, N. Y.
[RE: ACCOMMODATION OF RADIOACTIVE IMPURITIES IN THE REPROCESSING OF THE BROMINE TRIFLUORIDE TO BROMINE PENTAFLUORIDE]. E. I. Goodman. June 15, 1954. Decl. Nov. 16, 1955. 8p. $1.80(ph OTS); $1.80(mf OTS).

5920 CF-57-10-46
Oak Ridge National Lab., Tenn.
COST ESTIMATE FOR PRODUCTION OF THORIUM TETRACHLORIDE AND THORIUM METAL BY THE METALLEX PROCESS. O. C. Dean, W. F. Schaffer, and J. C. Suddath. Oct. 14, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The cost of producing thorium metal from thorium nitrate is estimated as $1.81 per pound by the PDA (propylene diamine) flowsheet and $1.96 per pound by the Dry Salt flowsheet. The initial plant investment for the PDA plant is higher ($7,018,725) than that for the Dry Salt plant ($6,235,971), but the annual operating cost, not including depreciation, is higher for the Dry Salt plant ($3,942,910 vs. $3,388,480 per year). The total annual

operating costs for each plant, including 20% annual depreciation, are $4,792,224 for the PDA plant and $5,190,101 for the Dry Salt plant, with each producing 4 tons of thorium metal sinter per day (330 days' operation per year). (auth)

5921 HEC-83

Hooker Electrochemical Co., Niagara Falls, N. Y.

AEC RESEARCH AND DEVELOPMENT QUARTERLY REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER 1957. George T. Miller. Jan. 15, 1958. 20p. Contract AT(30-1)-1524. $4.80(ph OTS); $2.70(mf OTS).

Further study has been made on the effects of additives to the electrolyte of the fused salt cell for the production of boron. The most significant findings are that calcium apparently inhibits the adherence of the boron deposit to the cathode and aluminum apparently improves purity, recovery, and crystallinity. When drying elemental boron, degradation with time has been shown. Highest purity of boron has been obtained by using short (1½ to 2 hrs) drying time at 100°C under vacuum conditions. It has also been shown that drying in oxygen yields higher purity boron than an air atmosphere. An air atmosphere yields higher purity boron than an argon atmosphere. A method for reclaiming KBF_4 from spent electrolyte has been developed. (auth)

5922 IDO-14372(Del.)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EVALUATION OF ICPP FOR DETROIT-EDISON COMPANY FBR II FUEL PROCESSING. H. Schneider. Oct. 18, 1954. Decl. with deletions Feb. 25, 1957. 22p. Contract AT(10-1)-205. (CPP-54-97(Del.)). $4.80(ph OTS); $2.70(mf OTS)

The processing of a 2% Zr–U alloy type fuel is feasible. Recovery of core and blanket can be accomplished at rates compatible with reactor discharge rates with only minor process and equipment modifications and additions. Cost data are summarized. (F.S.)

5923 ISC-475(Del.)

Ames Lab., Ames, Iowa.

THE SEPARATION OF ISOTOPES BY ION-EXCHANGE. F. H. Spedding, J. E. Powell, H. J. Svec, J. L. Evans, and R. E. Harrington. PROGRESS REPORT ON THE SEPARATION OF ISOTOPES ON ION-EXCHANGE COLUMNS. F. H. Spedding and J. E. Powell. Apr. 7, 1957. Decl. with deletions Feb. 25, 1957. 15p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

Progress of the work on the separation of isotopes on ion exchange columns is reported. Results indicate that isotopes can be separated in high purity, fairly rapidly, and with relatively inexpensive equipment by ion exchange methods. (J.E.D.)

5924 NMI-1167

Nuclear Metals, Inc., Cambridge, Mass.

REMOVAL OF FISSION PRODUCT GASES BY TRANSIENT MELTING. A. R. Gilman. May 6, 1957. Decl. Aug. 2, 1957. 52p. Contract AT(30-1)-1565. $9.30(ph OTS); $3.60(mf OTS).

Coextruded pin-type fuel elements were obtained with Xe in the core as a result of the decay of I^{131} introduced by previously melting the U with NaI^{131}. The removal of the Xe was attempted by transient melting in a vacuum at a speed of 3 to 5 in./min. The temperature was maintained low enough to enable the cladding to support the vertically-mounted rod and to minimize solution of the cladding in the core. Essentially complete Xe removal was achieved in the first pass, but N_2 and H_2 evolution persisted in subsequent passes. (auth)

5925

SEPARATING HAFNIUM FROM ZIRCONIUM. SOLVENT EXTRACTION WITH TRIBUTYL PHOSPHATE. R. P. Cox, H. C. Peterson, and G. H. Beyer (Univ. of Missouri, Columbia). Ind. Eng. Chem. 50, 141-3(1958) Feb.

A schematic flow diagram of a possible Zr process is illustrated. Zircon sand, treated with caustic, is converted into aqueous $Zr(NO_3)_4$ solution and extracted with tributyl phosphate. The solvent preferentially dissolves Zr, leaving Hf in the aqueous phase. The purified Zr is stripped from the solvent with water or dilute H_2SO_4, and the solvent re-used. Zirconium sulfate is then converted to either the oxide or the fluoride, as a preliminary step in metal preparation. (W.L.H.)

5926

PURIFYING THORIUM NITRATE BY SOLVENT EXTRACTION. D. D. Foley and R. B. Filbert, Jr. (Battelle Memorial Inst., Columbus, Ohio). Ind. Eng. Chem. 50, 144 (1958) Feb.

A liquid-liquid extraction process was developed for purifying mantle grade $Th(NO_3)_4$. (W.L.H.)

5927

TRIBUTYL PHOSPHATE–HYDROCARBON SYSTEMS. ORGANIZING EQUILIBRIUM DATA. J. W. Codding, W. O. Haas, Jr., and F. K. Heumann (Knolls Atomic Power Lab., Schenectady, N. Y.). Ind. Eng. Chem. 50, 145-52(1958) Feb.

Equilibrium data are given for solvent extraction systems. The organic phase of the system studied was 30 vol. % TBP in a kerosene-type diluent; the aqueous phase was 0 to 4M HNO_3; and the extracting species were uranyl nitrate, plutonyl nitrate, tetravalent Pu, and Th. (W.L.H.)

5928

SEPARATION OF MONAZITE RARE EARTHS BY SOLVENT EXTRACTION. Julius Bochinski, Morton Smutz, and F. H. Spedding (Ames Lab., Ames, Iowa). Ind. Eng. Chem. 50, 157-60(1958) Feb.

Equilibrium data for the rare earth nitrate–water–tributyl phosphate systems are presented, with a simple algebraic method of calculating the proper operating conditions needed to effect a given separation. Predicted results agree with those obtained in a simulated continuous countercurrent extractor. (auth)

5929

SOLVENT EXTRACTION SYSTEM FOR ENRICHED URANIUM. Joe Dykstra, B. H. Thompson, and R. J. Clouse (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Ind. Eng. Chem. 50, 161-5(1958) Feb.

Test data show that the most efficient extractive column operation occurs 10 to 20 r.p.m. below flood for the solvent extraction of enriched U. (W.L.H.)

5930

NEW ION EXCHANGE RESIN FOR URANIUM RECOVERY. A. H. Greer, A. B. Mindler, and J. P. Termini (Permutit Co., New York). Ind. Eng. Chem. 50, 166-70(1958) Feb.

A new resin, developed specifically for U recovery from H_2SO_4 leach liquors, is available commercially–Permutit SK for resin-in-column operation and Permutite SKB for resin-in-pulp operation. These resins have a fast U adsorption rate and a fast and a complete U elution rate. They have good physical and chemical stability which will mean a minimum of physical breakdown and only a small loss in U capacity. (W.L.H.)

5931

ENGINEERING DESIGN OF OAK RIDGE FLUORIDE VOLATILITY PILOT PLANT. Robert P. Milford (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 50, 187-91 (1958) Feb.

The new facility will demonstrate U recovery from spent Zr-enriched U fuels by volatilization of UF_6 and absorption on NaF. (auth)

5932
SOME CATION-EXCHANGE EQUILIBRIA ON DOWEX 50 AT 25°. O. D. Bonner, C. F. Jumper, and O. C. Rogers (Univ. of South Carolina, Columbia). J. Phys. Chem. 62, 250-3(1958) Feb.

Summaries of the results of ion-exchange equilibria and of maximum water uptakes at 25° of Dowex 50 resins of 4, 8, and 16% DVB content are given for the following systems: $NH_3OH^+-H^+$, $Ca^{+2}-Ni^{+2}$, $Mn^{+2}-Ni^{+2}$, $Ba^{+2}-Be^{+2}$, $Ce^{+3}-Ag^+$, $La^{+3}-Ce^{+3}$, $Ce^{+3}-Cr^{+3}$. (J.S.R.)

Syntheses

Refer also to abstract 6367.

5933
THE CHEMISTRY OF IODINATION. Walter L. Hughes (Brookhaven National Lab., Upton, N. Y.). Ann. N. Y. Acad. Sci. 70 (Art. 1), 3-18(1957) Aug. 30.

Reactions involved in the iodination of proteins are discussed. Procedures for the preparation of I^{131}-labeled proteins are described. (C.H.)

Tracer Applications

5934
TOTAL-COUNT TECHNIQUE IN THE REFINERY. D. E. Bull (California Research Corp., Richmond). Ind. Eng. Chem. 50, 199-200(1958) Feb.

A new principle in measuring flow rates, called the total-count method, is based on measurement of the total number of counts from a radioactive tracer as it flows past a detector. (W.L.H.)

5935
RADIOISOTOPES IN PETROLEUM REFINING. W. H. King, Jr. (Esso Research and Engineering Co., Linden, N. J.). Ind. Eng. Chem. 50, 201-4(1958) Feb.

The use of radioisotopes as tracers in petroleum refining is described. (W.L.H.)

5936
A RADIO TRACER FOR STUDYING SEWAGE DISTRIBUTION. Eli I. Goodman (Nuclear Science and Engineering Corp., Pittsburgh, Penna.). Ind. Eng. Chem. 50, 210-11 (1958) Feb.

5937
A NEW TRACER METHOD FOR KINETIC INVESTIGATIONS. M. B. Neiman (Academy of Sciences of USSR, Moscow). Intern. J. Appl. Radiation and Isotopes 3, 20-30(1958).

The theoretical basis of a new tracer method for determining the formation and consumption rates of intermediate products in complex chemical and biochemical reactions is presented. The method allows also the study of the successive formation of a number of intermediate products and the reaction order accounting for the consumption of intermediate products. Experimental data are included from kinetic investigations of methane, propylene, and butane oxidation, on the propane cracking mechanism, on kinetics of catalytic dehydrogenation of butane and butylene, and on the desorption of radicals from the catalyst surface. (auth)

Transuranic Elements and Compounds

Refer also to abstract 6368.

5938 AERE-C/R-2410
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
OXIDATION POTENTIAL OF THE Pu(III)--Pu(IV) COUPLE IN 8M AMMONIUM NITRATE-0.5N NITRIC ACID SOLUTION. J. L. Bunce and J. D. Nye. Aug. 1950. Decl. July 1957. 10p. $0.32(BIS).

Declassified version of AERE-C/R-571.

An approximate determination has been made of the formal potential of the $Pu^{3+}-Pu^{4+}$ couple in a solution which is 8M in ammonium nitrate and 0.5N in nitric acid. A value of −0.90 volts was obtained, while in the absence of ammonium nitrate the value was found to be −0.89 volts, which is in reasonably close agreement with the figure of −0.916 quoted in the literature for 1N nitric acid. (auth)

5939 AERE-C/R-2445
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PREPARATION OF ANHYDROUS PLUTONIUM TRICHLORIDE. B. R. Harder, F. Hudswell, and K. L. Wilkinson. Dec. 1957. 6p.

Several known methods for small-scale preparation of $PuCl_3$ have been studied for adaptation to a larger scale. A new method, that of the thermal decomposition of dipyridinium plutonium hexachloride, can be used for 10 g or larger quantities but the $PuCl_3$ product is impure. The best method, involving the intermediate preparation of Pu^{3+} oxalate, has been published previously but improvements have been made in the present study. (auth)

5940
CONDITIONS FOR THE FORMATION AND STABILITY OF OXALATE COMPLEX COMPOUNDS OF Pu(III) IN AQUEOUS SOLUTIONS. A. D. Gelman, N. N. Matorina, and A. I. Moskvin. (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.) Doklady Akad. Nauk S.S.S.R. 117, 88-91(1957) Nov. 1. (In Russian)

Uranium and Uranium Compounds

5941 AECD-3697
[Chicago. Univ.] Metallurgical Lab.
PRODUCTION OF URANIUM METAL BY THE HOT WIRE TECHNIQUE. Final Report on Problem No. 215-ML-54-4, File Serial 52. G. Derge, M. Fine, G. Monet, I. Rehn, and A. Rodrigues. Oct. 26, 1944. Decl. with deletions Oct. 19, 1955. 33p. Metallurgical Project. (Undeleted version: CK-2278.) $0.25(OTS).

The initial research used a flow system in which H_2 and I_2 passed over crude U at 500°C to form UI_4 which decomposed on a ThO_2-coated tungsten filament. The filament operated at 1500°C. The pure U dripped into a crucible in the cooler part of the furnace. This produced spectroscopically pure metal, and alternative designs were made to simplify operation and extend it to larger scales. One such design used a thermal gradient with the crude metal at the cool end of the tube and the pure metal at the hot end. This apparatus worked according to plan and was extremely promising. A sealed system without flow of gases was useful for theoretical studies only and established the limiting pressures for H_2. Another varia-

tion depending on a vapor phase reduction is under development. (auth)

5942 AERE-C/R-2276

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF URANIUM TRIOXIDE BY THERMAL DECOMPOSITION OF URANYL NITRATE. B. A. J. Lister and R. J. Richardson. Oct. 18, 1954. Decl. with amendment Apr. 25, 1957. 15p. $0.45(BSI).

Declassified version of AERE-C/R-1535.

A comparison has been made between the uranium trioxides prepared by thermal decomposition of uranyl nitrate and of ammonium diuranate. An attempt has been made to follow the course of the denitration reaction, and physical properties of the material at various stages in the decomposition have been measured. Good decontamination from ruthenium has been obtained during decomposition of the nitrate. (auth)

5943 AERE-GP/R-2409

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

PREPARATION OF URANIUM TETRACHLORIDE. E. R. Harrison. 1951. Decl. Apr. 1957. 12p. $0.45(BSI).

A method is described for preparing kilogram quantities of UCl_4. The known disadvantages of alternative methods are commented upon, particularly when the UCl_4 is required for use in vacuo with ion arcs. Active UO_2 is chlorinated in the vapor phase with carbon tetrachloride at a temperature of 500°C. The UO_2 is contained within a closed reaction vessel to which is connected a reflux condenser. Initially, the CCl_4 is fed into the vessel at such a rate that relatively large quantities condense in the reflux condenser. Because of the escape of non-condensible exhaust gases most of the CCl_4 is trapped in the condenser and maintained in a state of agitation. The more volatile, higher valency chlorides formed are carried into the condenser and, owing to their solubility in CCl_4, are retained and eventually washed back into the reaction vessel. The U losses from such a system were approximately 0.1%. Quantities of 4 to 5 kilos were produced in a single operation; the nonvolatile content was estimated to be less than 3%. The UCl_4 was then heated in vacuo at 500°C for about 5 hours; the small sublimate, 2 to 3%, appeared to consist entirely of organic compounds. (auth)

5944 BRB-7(Del.)

Bridgeport Brass Co., Conn.

HARDNESS EVALUATION OF ALPHA HOT-ROLLED URANIUM ROD FOR DRAWING. M. T. McGowan, H. S. Rubenstein, and R. M. Treco. Aug. 31, 1955. Decl. with deletions Feb. 13, 1957. 27p. Contract AT(30-1)-1405. $4.80(ph OTS); $2.70(mf OTS).

Microhardness examination of hot rolled FMPC uranium rod before and after beta-treatment and drawing revealed the presence of non-uniform hardening throughout the cross-section. Significantly hard annuli were found on transverse sections of material both drawn and not drawn in the region immediately below the surface to a depth of 0.050". The inhomogeneity in hardness present in the hot-rolled rods remained with area reductions up to 9% and die angles up to 15 degrees. Beta treating followed by cold drawing apparently shifted the hardness maximum towards the center of the rods. The greatest effect on hardness seemed to be at a point near 0.050" below the surface. (auth)

5945 WAPD-T-346(Rev. 1)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

A KINETIC STUDY OF THE OXIDATION OF URANIUM DIOXIDE. S. Aronson, R. B. Roof, Jr., and J. Belle. July 1, 1956. 29p. Contract AT-11-1-GEN-14. $4.80 (ph OTS); $2.70(mf OTS).

Oxidation of UO_2 to U_3O_8 in dry air and oxygen at temperatures of 160 to 350°C proceeds by a two-step reaction. In the first step the tetragonal oxide of composition $UO_{2.34 \pm 0.03}$ is formed. In the second step this tetragonal phase is converted to orthorhombic U_3O_8. The rate controlling process in the first stage is the diffusion of oxygen through the UO_2 lattice. The value found for the diffusion coefficient D is $D = 5.5 \times 10^{-3} \exp[-(26{,}300 \pm 1500)/RT]$, where the activation energy is 26.3 ± 1.5 kcal/mole. The second stage of the reaction proceeds by a nucleation and growth process. The value found for the activation energy for growth is 35.9 ± 2.0 kcal/mole. (auth)

5946

THE OXYSELENIDE OF URANIUM, USeO. Parviz Khodadad. Compt. rend. 245, 2286-8(1957) Dec. 16. (In French)

Some new methods of preparation of USeO are indicated. The crystalline structure was verified, and the density and the magnetic susceptibility were measured. The study of the chemical properties reveals the differences between the oxyselenide and the compounds USe_3 and Se_2 $U_{\alpha,\beta,\gamma}$. USeO reacts with Al powder to give U_2Se_3, the crystal structure of which is described. (J.S.R.)

5947

THE EXTRACTION OF URANIUM(VI) FROM ACID PERCHLORATE SOLUTIONS BY DI-(2-ETHYLHEXYL)-PHOSPHORIC ACID IN n-HEXANE. C. F. Baes, Jr., Ralph A. Zingaro, and C. F. Coleman (Oak Ridge National Lab., Tenn. and Agricultural and Mechanical Coll. of Texas, College Station). J. Phys. Chem. 62, 129-36 (1958) Feb.

The distribution of uranium(VI) between acidic aqueous perchlorate solutions and solutions of di-(2-ethylhexyl)-phosphoric acid [$(RO)_2PO_2H$, DPA] in n-hexane has been examined as a function of various extraction variables at constant aqueous ionic strength. The organic solutions involved have been investigated by means of isopiestic molecular weight determinations and viscosity measurements. The distribution behavior at low uranium levels conforms approximately to the relation $E_a^0 = C_{U(0)}/C_{U(a)} = KC_{DPA}^2/C_H^2$ in which $C_{U(0)}$ and $C_{U(a)}$ are, respectively, the organic and the aqueous phase uranium(VI) concentrations, C_{DPA} is the organic extractant concentration and C_H is the aqueous acidity. Since the isopiestic results indicate that DPA is dimeric in hexane solutions over the concentration range used (0.01 – 1M DPA), the principal extraction reaction at low uranium levels appears to be $UO_2^{++}(a) + 2(HX)_2(o) \rightleftharpoons UO_2X_4H_2(o) + 2H^+(a)$ in which X denotes the anion $(RO_2)PO_2^-$. As the ratio $C_{U(0)}/C_{DPA}$ increases above 0.25, the isopiestic results indicate molecular association which increases as saturation is approached ($C_{U(0)}/C_{DPA} \rightarrow 0.5$). Consistent with this, above $C_{U(0)}/C_{DPA} = 0.45$, the viscosity rises sharply. These results, together with the extraction behavior in the vicinity of saturation, are discussed in terms of the formation of chain polymers of the type $HX_2UO_2X_2UO_2-X_2UO_2X_2H$. (auth)

Waste Disposal

5948 IDO-14367(Del.)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EVALUATION OF WASTE DISPOSAL BY ELECTRODEIONIZATION AND CLAY ABSORPTION. W. H. Burgus and E. S. Grimmett. Oct. 20, 1954. Decl. with deletions

Mar. 14, 1957. 14p. Contract AT(10-1)-205. (CPP-54-103(Del.)). $3.30(ph OTS); $2.40(mf OTS).

An evaluation of waste disposal by electrodeionization and clay absorption was made. A description of the process, engineering feasibility, flowsheets, and a rough cost estimate for the process are given. (F.S.)

5949 IGS-R/R-3

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

A SUMMARY OF THE BIOLOGICAL INVESTIGATIONS OF THE DISCHARGES OF AQUEOUS RADIOACTIVE WASTE TO THE SEA FROM WINDSCALE WORKS, SELLAFIELD, CUMBERLAND. H. J. Dunster and F. R. Farmer. Jan. 1958. 14p.

For about five years, experimental discharges of radioactivity have been made from the United Kingdom Atomic Energy Authority's Windscale Works, Sellafield, to the coastal water off Cumberland. Samples of fish, seaweed, sea bed and shore sand have regularly been taken and their activity assessed. This report summarizes the results of that program and concludes that the maximum permissible discharge rate is not less than 15,000 curies per month of total beta activity. Specific limitations are necessary for strontium 90 and for plutonium, and possibly for ruthenium 106. (auth)

ENGINEERING

Refer also to abstract 6370.

5950 AERE-E/R-2217

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE VISCOSITY PLATE THRUST BEARING. D. V. Wordsworth. 1958. Date of MS. Oct. 1952. Decl. Nov. 6, 1956. 53p. $1.44(BIS).

The results of tests on a viscosity plate thrust bearing indicated that serious differences existed between theoretical predictions by existing methods and experimental values. In particular the load carrying capacity at any speed and plate gap was much overestimated by calculation, and the variation of load with speed, at constant gap, appeared to be quite different in theory and experiment. While the theoretical load speed curve departed by only a small amount from linearity, the experimental curves indicated a definite flattening out at high speed, and corresponding to a given gap, a maximum load was reached and maintained independent of speed. It is the aim of this investigation to find the reason for this flattening out of the curve, and to indicate why it is not shown by the theoretical methods. The aerodynamic theory of viscosity plate bearings is considered, and taking into account as many aerodynamic effects as possible, a new method of performance prediction is developed. Results by this method agree quite well with those of existing methods, and therefore the effect which is being looked for cannot be an aerodynamic one already included in the method. Other possible explanations are considered including centrifugal action on the gas, heating up the gas due to frictional losses, a comparison of the plate gap with the mean free path of molecules of the gas, and distortion of the grooved plate under pressure load. Of these it is shown that the first three are not important, but that with the type of plate mounting used in the experiments very serious deflections of the stationary plate can be expected at high speed. At 21,000 rpm and a plate gap of 2.0×10^{-4} in. and with the theoretically predicted load, the plate deflection reaches a maximum of about five times the nominal gap and moreover varies considerably with radius and around the disc. (auth)

5951 NP-tr-56

INDUCTION HEATING AT MAINS FREQUENCY. R. Lethen. Translated by S. Asher from Elektrotechniek 34, 455-65 (1956). 18p.

A general survey is made of the principle methods of inductive heating. The special problems arising from the use of line frequency which is carried through a variable transformer and then inductively into the inducting material are first considered generally. The applications of induction heating by line frequency alone are discussed with respect to smelting, superheating, and thermostatting, the warming and annealing of pig iron, and the heating of chemical apparatus. (J.S.R.)

Heat Transfer and Fluid Flow

Refer also to abstract 6373.

5952 AERE-R/R-2190

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

EXPERIENCE OBTAINED ON A LIQUID SODIUM HEAT TRANSFER RIG 1954/1956. E. C. Firman, R. I. Hawes, and D. W. G. Sturge. Aug. 1957. 31p. (LMFT/P-19).

Heat transfer data for Na flowing at moderately low Reynolds number in a double annulus heat exchanger are reported. The results qualitatively confirm the findings of coefficients well below the theoretical minimum. Addition of an inert gas to the flowing liquid produced a pronounced lowering of the heat transfer coefficient. After some 1400 hr operation, deposits mainly of Na_2O occurred throughout the apparatus. It is shown that such deposits could be an important factor in depressing the heat transfer coefficient. It is not claimed, however that this is the only or principal factor. Other possibilities are commented upon. General operating experience is also described. The experiment included an investigation of the metallurgical changes occurring in a dynamic Na in stainless steel system and the results are compared with static controls. (auth)

5953 BNL-3202

[Brookhaven National Lab., Upton, N. Y.].

LMFR [PROJECT]. C. F. Bonilla. June 26, 1952. Decl. Nov. 16, 1955. 29p. $4.80(ph OTS); $2.70(mf OTS).

Two studies were carried out on the LMFR project. These are: "Optimum Design of Bi–Na Heat Exchanger" and "Optimum Velocity of Bi and Na in Pipes." It is shown that the range of economical velocities in a Bi–Na heat exchanger operating at 90°F temperature differential under the conditions of LMFR is between 4 and 8 ft/sec, depending on pump efficiency and other factors. It is also shown that the most economical velocity for the circulation of the Na under LMFR conditions is about 25 to 28 ft/sec, and for the Bi 18 to 45 ft/sec. (M.H.R.)

5954 NDA-57-30

Nuclear Development Corp. of America, White Plains, N. Y.

INVESTIGATION OF THE CHARACTERISTICS AND FEASIBILITY OF AN ELECTROLYTIC HEAT TRANSFER ANALOG. P. Anthony and G. Friedensohn. Oct. 13, 1956. 54p. For Pratt and Whitney Aircraft Div. $9.30(ph OTS); $3.60(mf OTS).

An electrolytic heat transfer analog was required capable of simulating two-dimensional problems of various configurations involving distributed heat sources and a number

of coolant passages. A design study was made of the characteristics of electrolytic analogs. A small analog of fixed geometry was fabricated and tested to establish the validity of, and to obtain the design specifications for a full scale device. Internal temperature differences deduced from measurements taken on the small analog agreed within 5% with those obtained by a numerical solution of the same problem. (auth)

5955 NP-tr-40

AN EQUATION FOR DETERMINING COEFFICIENTS OF HEAT TRANSFER FOR BOILING LIQUIDS. A. I. Rychkov and A. N. Planovskii. Translated by R. C. Murray from Khim. Prom. 5, 31-3(1955). 7p.

Materials Testing

5956 AECU-3622

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

THE DESIGN AND CONSTRUCTION OF A TEST LOOP FOR THE STUDY OF AN ELECTROMAGNETIC PUMP AND FLOWMETER ON LITHIUM SYSTEMS. E. I. Goodman and R. Bakal. Sept. 13, 1950. 25p. [For Carbide and Carbon Chemicals Div. K-25 Plant. Contract W-7405-eng-26, Subcontract 70]. (KT-100). $4.80(ph OTS); $2.70(mf OTS).

5957 AERE-R/M-148

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE COMMISSIONING AND OPERATION OF A SMALL BISMUTH LOOP AND TESTS ON A D.C. ELECTROMAGNETIC PUMP. E. H. Aldworth. Oct. 1957. 15p. $0.54(BIS).

A 1-in. N.B. test loop has been constructed in order to obtain the pressure/flow characteristics of a d-c electromagnetic pump circulating liquid bismuth at temperatures up to 450°C. The characteristics of the pump and details of the loop are given including the methods of measuring flow and pressure. A flow of 10 gallons per minute at 50 lb/in.^{2} was obtained with a current input of 4,800 amps. when circulating bismuth without additives. (auth)

5958 D-14715

Boeing Airplane Co., Seattle.

ELEVATED TEMPERATURE DESIGN CRITERIA—STRUCTURAL METALS AND ALLOYS. Structural Development Note No. 17. S. H. Myhre. Feb. 1, 1954. Included in this report is Addendum No. 3: TIME DEPENDENT DEFORMATION PROPERTIES BY S. D. Elrod. Jan. 19, 1956. 89p.

The present study is confined to stress-rupture. The rupture-strength, defined as the stress which will cause rupture in a specified time and temperature, can be plotted against a single function (F + 460)(C + log t), where F is temperature in degrees F, t is time to rupture in hours, and C is a material constant usually equal to 20. In this manner interpolation and extrapolation of the test data and comparison of materials are facilitated. Stress-rupture curves for about 80 materials are presented and compared on both a strength and a strength/weight basis. (auth)

5959 LA-2175

Los Alamos Scientific Lab., N. Mex.

AN AUTOGRAPHIC STRAIN-GAGE DILATOMETER FOR PLUTONIUM AND ITS ALLOYS. R. O. Elliott and W. N. Miner. June 1952. 24p. Contract W-7405-eng-36. $0.75(OTS).

A vacuum dilatometer for use in determining the expansion characteristics of plutonium and its alloys is described. The dilatometer consists of a vertical silica tube containing the specimen and a silica push tube which transmits specimen expansion to a cantilever beam. Strain gages cemented to the beam convert linear displacement of the specimen into an electrical signal that is fed to a Leeds and Northrup X-Y recorder. Specimen temperature, as determined by a thermocouple, is also fed to the recorder. Heating of the specimen is obtained by means of a split-tube furnace. The principal advantages of this dilatometer over the popular silica-tube and dial-indicator dilatometer include light loading of the specimen and continuous autographic recording of expansion-versus-temperature data. Experience has shown this dilatometer to be simple in operation, reliable and adaptable to determining the expansion characteristics of a large number of plutonium alloys. (auth)

5960 NP-6580

Denver. Univ. Denver Research Inst.

DETONATOR CHARACTERIZATION. Phase Report No. 1 [on] PRELIMINARY SENSITIVITY TESTS. Charles E. Eppinger. Jan. 3, 1958. 39p. Project No. PA-3-1. Contract DAI-23-072-501-ORD-(P)-37.

Initiator characterization apparatus was designed for the function of evaluating initiators including small relays, stab-type primers, stab-initiated detonators, flash-initiated detonators, and blasting caps by controlled firing and measuring of various output data. Detailed results of preliminary sensitivity tests which have been completed are included. (W.L.H.)

5961 NP-tr-47

RISK OF FLOW AND FRACTURE IN MULTI-AXIAL STRESS. Translated by N. Willis from Metall 10, 795-800(1956). 17p.

It is essential to distinguish between the risk of flow, which is a consequence of excessive deformation and of fracture through creep and stress corrosion, and the risk of proper fracture (i.e. abrupt fracture). For the case of the risk of flow a limiting condition can be set up on the basis of the elastic properties, which applies to all materials. In this the change of shape produced by the state of stress is the controlling factor. It is shown that there are two different kinds of change of shape, namely an axially symmetrical volume change and a planar change: these two must be considered separately. This leads to a theory for the risk of flow, which departs from the hypothesis concerning the energy involved in a change of shape by no more than 3.4. A theory for the risk of fracture under abrupt stress cannot be given in a form which applies to all materials. The reason for this is that the risk of fracture depends on the ductility of the material. A relation is given which describes the defendence of the risk of fracture in the material on the ductility coefficient. The ductility coefficient is connected with the transverse contraction coefficient. The reciprocal of its value gives the limiting shear stress for which the material follows the shear stress hypothesis under very high pressure stress on all sides. (auth)

Pumps

5962

A CIRCULATING PUMP FOR QUANTITATIVE ESTIMATION OF SERIAL RADIOISOTOPE UPTAKE IN VITRO. Donald R. Osgood, Julian D. Boyd, and Alvin S. Blum (Veterans Administration Hosp., Coral Gables, Fla.). Intern. J. Appl. Radiation and Isotopes 3, 43-4(1958).

Tracer Applications

Refer to abstracts 6371 and 6372.

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

Refer also to abstract 6378.

5963 BMI-860
Battelle Memorial Inst., Columbus, Ohio.
THE APPLICATION OF CERAMICS TO HANFORD FUEL ELEMENTS. B. W. King, H. P. Tripp, and W. H. Duckworth. Sept. 4, 1953. Decl. Feb. 18, 1958. 39p. Contract W-7405-eng-92. $6.30(ph OTS); $3.00(mf OTS).

Various possible applications of ceramic materials in the construction of fuel elements used at Hanford are reviewed. These uses might be: (1) a protective outer coating on the Al-jacketed U slugs, (2) a protective layer between the Al and U, (3) a seal to retard interdiffusion between the Al and U, (4) secondary protection on the ends of the slug in case of failure of the Al can, (5) a thermal barrier on the ends of the slug, and (6) sole protection of the U in atmospheres other than water. Possible ceramic materials for these applications are: (a) enamels for Al, U, and Zr, (b) stable anodized coatings for Al, and (c) a limited number of bodies for enclosure in the ends of the Al can. A number of enamels were developed for use on U, and it also was established that Zr could be enameled without need for unusual processes. Data were obtained that indicated improved resistance to water can be obtained from anodized Al by using unique sealing procedures. (auth)

5964
DETERMINATION OF RESIDUAL STRESSES IN TITANIUM CARBIDE-BASE CERMETS BY HIGH-TEMPERATURE X-RAY DIFFRACTION. Herbert W. Newkirk, Jr. and Harry H. Sisler (Ohio State Univ., Columbus). J. Am. Ceram. Soc. 41, 93-103(1958) Mar.

Corrosion

5965 EES-010359A
Naval Engineering Experiment Station, Annapolis.
INVESTIGATION OF CHEMICAL INHIBITORS FOR STRESS-CORROSION CRACKING OF STAINLESS STEEL. Summary Report [for] January 1954 to June 1957. F. E. Clarke and A. J. Ristaino. Sept. 9, 1957. 18p.

Since recommending coordinated phosphate-pH control for the STR boiler in 1950, numerous laboratory tests, experimental boiler tests, and actual service tests have been made of this treatment with and without supplementary chemical inhibitors, to determine its merit in maintaining proper waterside conditions and particularly in preventing stress-corrosion cracking. It has been determined that the treatment originally recommended affords adequate protection for both mild steel and stainless steel surfaces completely submerged in boiler water. However, stainless steel parts exposed intermittently to the boiler water and its vapor are not protected against stress-corrosion cracking if both dissolved oxygen (or certain oxidizing agents) and chloride ion are present. There is evidence that caustic alone will cause cracking under the same conditions. This damage has been prevented by supplementary treatment with sodium sulfite oxygen scavenger. A more practicable inhibitor for the stress-corrosion problem still is being sought. (auth)

5966 NYO-839
Pennsylvania State Univ., University Park.
THE CORROSION OF ZIRCONIUM. Final Report. H. J. Read. Dec. 16, 1953. 12p. Contract AT(30-1)-993. $3.30(ph OTS); $2.40(mf OTS).

Theoretical considerations of defect structures indicate that the rate of corrosion of Zr contaminated with N_2 should be reduced by addition of a suitable anion to the environment or a cation to the metal. Exploratory experiments showed a spectacular reduction in the rate of corrosion of nitrogen-bearing Zr when a trace of fluoride ion, from CaF_2, was added to the environment in a hot-water test at 350°C. Extensive experiments did not confirm the exploratory work and served only to show that, in all probability, some unrecognized factor or factors must be found and brought under control. All efforts to determine why corrosion control was achieved in some runs and not in others where conditions seemed identical were fruitless and the project was terminated. (auth)

5967 WADC-TR-57-195
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
TEST METHODS FOR MAGNESIUM SURFACE TREATMENTS. Period Covered: February 1, 1955 to July 1, 1956. Frank W. Pfohl and Howard T. Francis. Aug. 23, 1957. 62p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTROCHEMICAL TREATMENTS. Contract AF33(616)-2855. (AD-142146).

A study was made of test methods whereby the quality of Mg surface treatments could be determined. Methods which measured the corrosion-inhibiting power of the coating were found unsatisfactory. A method based on measurement of paint adherence after exposure to a corrosive environment was found quite promising. The latter approach evolved the "Gauze-Peel Test," in which a gauze strip is embedded in the organic coating. After exposure to accelerated corrosion, the gauze is peeled from the surface. Both quantitative (peel strength) and qualitative (visual examination of the stripped area) evaluations are easily made. An important observation made during preparation of experimental specimens was that contact between Mg and steel during Dow 7 treatment leads to rapidly deteriorating painted surfaces. (auth)

5968 Y-1151
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
THE INHIBITION OF HYDROGEN CORROSION OF URANIUM. A. Krieg and J. M. Napier—R. K. Bennett, ed. Dec. 12, 1957. 37p. Contract W-7405-eng-26. $1.25 (OTS).

The results of a series of qualitative U–H corrosion tests are presented. The effects of surface treatment and inhibitive agents on the corrosion reaction are discussed. (auth)

5969
CLASSIFICATION OF THE CORROSION RESISTANCE OF STEEL IN SATURATED SALT SOLUTIONS OF HYDROGEN SULFIDE UNDER PRESSURE. Eugène Herzog. Compt. rend. 245, 2280-2(1957) Dec. 16. (In French)

The corrosion resistance of steels in the presence of H_2S varies within large limits with the test conditions. The conditions of classification of steel corrosion in H_2S is defined, and the influence of hydrogen ion concentration, pre-

liminary cold working, and the force and distribution of the stress is discussed. (J.S.R.)

Geology and Mineralogy

5970 TEI-61(Pts. 1 and 2)
Geological Survey.
RECONNAISSANCE FOR TRACE ELEMENTS IN NORTH DAKOTA AND EASTERN MONTANA. PART 1. GEOLOGY AND RADIOACTIVITY. PART 2. RESERVES AND SUMMARY. Donald G. Wyant and Ernest P. Beroni. Feb. 1950. Pt. 1 Changed from OFFICIAL USE ONLY Feb. 28, 1956. Pt. 2 Decl. Mar. 9, 1956. 59p., 3 illus. $1.00(OTS).

5971
RADIOACTIVE TITANIFEROUS HEAVY-MINERAL DEPOSITS IN THE SAN JUAN BASIN, NEW MEXICO AND COLORADO. William L. Chenoweth (U. S. Atomic Energy Commission, Washington). New Mexico Geol. Soc. Eighth Field Conference, 212-17(1957) Oct.

Upper cretaceous rocks of the San Juan Basin contain titaniferous sandstone deposits as significant as any in the Rocky Mountains. Ilmenite in the deposits is highly altered, and as a result of Fe leaching it contains an increase percentage of TiO_2. Most of the ilmenite is free from intergrowths with magnetite. Radioactivity, fluorescent zircon, and characteristic sedimentary environment aid in the recognition of new deposits. (J.E.D.)

Metals and Metallurgy

Refer also to abstracts 6375, 6376, and 6377.

5972 AERE-M/M-179
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
PRELIMINARY FABRICATION STUDIES ON U–Th–Be FUEL ELEMENTS. W. J. Wright. Oct. 1957. 10p. (AAEC/ARC/P-48).

Preliminary studies on extrusion and hot forging of beryllium containing dispersed UBe_{13} and $ThBe_{13}$ are reported. Both processes are capable of consolidating the dispersion, and of integrally bonding a beryllium sheath to the core. For optimum irradiation behavior of the dispersion, and for ease of fabrication, well defined dense particles of compound are probably required. This will necessitate formation of the compounds by melting or high temperature sintering, prior to incorporation within the beryllium matrix. (auth)

5973 AGARD-103
North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.
SINTERED ALUMINIUM S.A.P. F. Bollenrath. Apr. 1957. 25p.

Presented at the Fifth Meeting of the Structures and Materials Panel, held from April 24 to 27, in Oslo, Norway.

A new material made by compressing, sintering, and extruding Al powder is described. This material is called S.A.P. (Sintered Aluminium Powder) and has been developed by Aluminium-Industrie A. G., Neuhausen, Switzerland. Outstanding are the mechanical properties at elevated temperatures. (auth)

5974 HW-52000
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM RECYCLE PROGRAM ANNUAL REPORT [FOR] FISCAL YEAR 1957. Sept. 20, 1957. 106p. Contract W-31-109-Eng-52. $2.75(OTS).

An integrated program was undertaken to develop a firm technological basis for the use of Pu as a fuel material for power reactors. Objectives in this program were the development of methods for fabricating inexpensive Pu-bearing fuel elements, collecting physics data necessary for the use of Pu as fuel, development of chemical processes for Pu recovery from fuel elements, and the evaluation of reactor types for Pu fuel suitability. Progress made toward the realization of these objectives is summarized. (D.E.B.)

5975 HW-52494
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
STATUS OF HAPO CREEP TESTING OF REACTOR STRUCTURAL MATERIALS. A. B. Burgess. Sept. 16, 1957. 21p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

The status of all creep tests completed or in progress at Hanford on Zircaloy-2 and aluminum alloy M-257 is summarized. (auth)

5976 KAPL-1343(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
SUMMARY TECHNICAL PROGRESS REPORT NO. 79 [FOR] APRIL 1955. Decl. with deletions Mar. 4, 1957. 15p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40 (mf OTS).

Progress notes on separation processes, fuel element fabrication, UO_2–NaK slurry studies and U metallurgy are given. (D.E.B.)

5977 KAPL-1555
Knolls Atomic Power Lab., Schenectady, N. Y.
PREPARATION OF NUCLEAR POISON AND CONTROL ALLOYS. ZIRCONIUM BASE–BORON ALLOYS. A. P. Beard, J. W. Harrison, and W. B. Clark. July 18, 1957. 30p. Contract W-31-109-Eng-52. $1.00(OTS).

Zirconium-base–boron alloys with nominal compositions of 0.2 to 3.0 wt. % boron were arc-melted and fabricated by hot extrusion and rolling. Chemical analyses of as-cast ingots, extruded rods, and rolled strip indicated high boron recovery and good homogeneity. Brinell hardness numbers were directly proportional, and measured densities were inversely proportional, to boron content. (auth)

5978 NAVORD-4155
Naval Ordnance Lab., White Oak, Md.
EFFECTS OF TEMPERATURE ON MAGNETIC PROPERTIES OF CORE MATERIALS. M. Pasnak. May 3, 1956. 36p.

An experimental study of the effects of temperature on the magnetic properties of a group of representative ferromagnetic alloys was made. The following alloys were studied: Orthonol, 5-79 and 4-79 Mo Permalloy, AEM 4750, 1.6, 3.5, and 6.4% Si–Fe, and 11.7 and 16 Alfenol. The cores consisted of ring laminations primarily, but some spiral wound tape cores were also included. Measurements of 60 cps dynamic loops were made in the temperature range from −60 to +100°C. For ring laminations, the results indicate that, generally, at high induction levels, high temperature depresses the maximum induction from its room temperature value, while low temperature elevates it. Similarly, high temperature depresses the residual induction. However, low temperature elevates the residual in some materials while it depresses it in others. Coercive force is depressed by high temperature and increased by low temperature. The a-c permeability, generally, is elevated by high temperature and depressed by low temperature. For spiral wound tape cores, the

results were erratic. This is attributed to the spiral construction, since when tests were made on laminations of the same alloy, the erratic behavior was absent. In the Si–Fe family of alloys tested, 3.5% Si–Fe was least affected by temperature changes, while 6.4% Si–Fe was most affected. In the Ni–Fe family, 4 and 5-79 Mo Permalloy were least affected, while AEM 4750 and Orthonol were more affected. In the Al–Fe family, 16 Alfenol was least affected, while 11.7 Alfenol was quite temperature sensitive. (auth)

5979 NP-6591

Massachusetts Inst. of Tech., Cambridge.

X-RAY DETERMINATION OF BETA PHASE IN TITANIUM ALLOYS. Technical Report No. 1 [on] PHYSICAL METALLURGY OF TITANIUM ALLOYS. M. F. Comerford, B. L. Averbach, and M. B. Bever. Jan. 31, 1958. 16p. Contract Nonr-1841(02).

The volume percent of β phase was determined in a Ti alloy of the type Ti–6Al–4V by measurements of integrated diffraction intensities. The (0002)α and (110)β diffraction lines were chosen because this combination minimizes the errors arising from preferred orientation. A diffracted beam monochromator was employed to eliminate the difficulties arising from fluorescence radiation. The results showed that samples quenched from 1475°F (800°C) contained approximately 5% β phase. However, on quenching from higher temperatures no β was found. The β phase was formed on aging, and in samples solution treated at 1570°F (855°C) approximately 10% β was formed after aging at 1000°F (540°C) for 24 hr. The β appears to form by a decomposition of the martensitic α' phase in this alloy. (auth)

5980 NP-6598

Olin Mathieson Chemical Corp., Niagara Falls, N. Y. and Syracuse Univ., N. Y.

CORROSIVITY, HANDLING, AND TRANSFER OF MOLTEN LITHIUM. Feb. 14, 1958. 118p. Contract AF33(600)-33920.

Problems of handling and corrosion during the electrolysis of LiCl in a 1000 amp electrolytic cell and in the hydrogenation of Li to LiH are described. The corrosive effects of molten Li on various materials of construction were investigated. (J.E.D.)

5981 NP-6609

Davison Chemical Co., Pompton Plains, N. J.

LITERATURE SEARCH RELATING TO METALLURGICAL APPLICATIONS OF THE RARE EARTHS. Ammiel Prochovnick. Feb. 1958. 45p.

A literature survey of the metallurgical applications (ferrous and nonferrous) of the rare earths was made. The period covered was from 1947 to 1957. (J.S.R.)

5982 SCTM-3-58(16)

Sandia Corp., Albuquerque, N. Mex.

TEST OF 61S-T6 ALUMINUM SHEET UNDER SHORT-DURATION, HIGH RATE OF RISE, HEATING. J. A. Barber. Jan. 20, 1958. 16p. Contract AT(29-1)-789. $0.50(OTS).

A test was performed to determine elongation and ultimate strength of 61S–T6 Al sheet metal in both welded and unwelded specimens in the 400 to 900°F temperature range. The rate of temperature rise was between 150 and 200°F per second. (auth)

5983 WAPD-NCE-7002

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

TECHNOLOGY SECTION QUARTERLY PROGRESS REPORT ON METALLURGICAL STUDIES OF ZIRCONIUM ALLOYS. J. G. Goodwin, J. D. Grozier, L. S. Rubenstein, and F. L. Shubert. Nov. 19, 1957. 48p. $7.80(ph OTS); $3.30(mf OTS).

The work at Bettis is being performed under two main categories, data analysis and metallurgical studies of Zr. The work at the subcontractors includes: phase-diagram studies of the Zr-rich portion of the Zr, Sn, Fe diagram; identification as to composition and structure of the precipitates in Zircaloy-2; investigation of the temperature limits of the alpha plus beta phase region on heating and cooling of vacuum-melted Zircaloy-2; investigation of the kinetics of the solution of the Fe–Ni–Cr constituent in the beta phase and the effect of impurity level on various properties of Zircaloy-2; and a metallographic study of Zircaloy-2. (W.L.H.)

5984 AEC-tr-3159

ZONAL STRUCTURE OF ELECTROLYTICALLY PRODUCED NICKEL LAYERS. W. G. Burgers and W. Elenbaas. Translated by K. S. Bevis from Naturwissenschaften 21, 465(1933). 3p.

5985 AERE-Lib/Trans-727

THE SURFACE TENSION OF THE BINARY METAL ALLOYS: Pb–Sn, Bi–Pb, Bi–Sn, AND Bi–Cd. R. V. Bakradze and B. Ya. Pines. Translated by T. Turton from Zhur. Tekh. Fiz. 23, 1548-58(1953). 13p.

The concentration and temperature dependence of the surface tension σ of liquid alloy systems Pb–Sn, Bi–Pb, Bi–Sn and Bi–Cd at temperatures up to 550°C were determined experimentally. The measurements on the alloys Pb–Sn were carried out in a vacuum by the method of ring break-away; measurements on the alloys Bi–Pb, Bi–Sn, and Bi–Cd were carried out in an H_2 atmosphere by the method of maximum pressure in bubbles. It was found that the temperature dependence of all the alloys investigated (in the temperature range investigated) was practically linear. The concentration relation of σ, however, differed substantially from the linear. In the system Pb–Sn, Bi–Sn, and Bi–Cd the surface tension of the alloy was always less than the additive value of σ for the given concentration, approaching the additive value on increase of the temperature. Values of σ, slightly greater than the additive values were obtained on heating the Bi–Pb system. The experimental data were compared with calculated results. (auth)

5986 AERE-Lib/Trans-773

THE EFFECT OF ALLOY STRUCTURE ON THE DIFFUSION PROCESS. L. M. Mirskii. Translated by J. Adam from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 11, 40-51(1956). 15p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 11, as abstract No. 3860. (J.E.D.)

5987 NP-tr-35

INDUCTIVE HEATING AT LOW FREQUENCIES. J. J. M. Roos. Translated by S. Fitzgerald from Elektrotechniek 32, 153-61(1954). 23p.

The importance of low and medium frequencies for industrial inductive heating is stressed. Three principles enabling the general understanding of practical inductive heating are explained and formulated. The sources of energy, direct mains supply for low temperature frequencies, and motor generators for the medium frequencies are reviewed. From the many applications in the metal heating field a few examples are reported in more or less detail. These applications belong to the general classes of surface hardening, homogeneous heating, welding, brazing, and heating for shrinking or loosening. (auth)

5988 NP-tr-38

INFLUENCE OF INTRAGRANULAR BOUNDARIES ON THE SELF-DIFFUSION COEFFICIENT OF IRON IN IRON–NICKEL–CARBON ALLOYS. B. M. Noskov, E. V. Kuznetsov, and G. V. Shcherbedinskiĭ. Translated by V. Beak from Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R., Ural' Filial 2, 489-93(1956). 6p.

An investigation was made of the self-diffusion coefficients of Fe in C–Fe–Ni alloys in samples of differing structure. It was found that in samples that had undergone the martensite transformation before diffusional annealing, the self-diffusion coefficient was 2 to 3 times as great as in samples that had not undergone the martensite transformation. The establishment of intragranular boundaries takes place gradually, the elimination process occurring with a definite activation energy. (auth)

5989

SODIUM-REDUCTION ROUTE YIELDS TITANIUM. T. Peter Forbath. Chem. Eng. 65, No. 5, 124-7(1958) Mar. 10.

A flowsheet for the commercial production of titanium sponge by the reduction of $TiCl_4$ with Na is given. (J.S.R.)

5990

EFFECTS OF HETEROGENEOUS STRESS ON ALLOTROPIC TRANSFORMATIONS OF COBALT. Hervé Bibring and Francois Sébilleau. Compt. rend. 245, 2269-71(1957) Dec. 16. (In French)

The effect of heterogeneous stresses on the transformation of cobalt was investigated. Stress, such as tempering or cold hammering, was proved to cause multiplication of the transformation centers, in which is initiated the transformation from the cubic face-centered structure to the hexagonal structure. (J.S.R.)

5991

EFFECT OF HEAT TREATMENT IN HYDROGEN ON THE PROPERTIES OF MAGNESIUM–ZIRCONIUM ALLOYS. Jean Hérenguel, Jacques Boghen, and Pierre Lelong. Compt. rend. 245, 2272-5(1957) Dec. 16. (In French)

Different Mg–Zr alloys were subjected to heat treatment at 500°C under an atmosphere of H_2 and compared with those treated at 500°C under an atmosphere of Ar or CO_2. Observations showed that, at this temperature, H_2 causes a rapid precipitation of the Zr hydride which results in a structural hardening. The hydride then unites very slowly with a resulting softening of the alloy. The mechanism is analogous to the hardening induced by internal oxidation with formation of a very slightly soluble oxide. The samples treated under Ar or CO_2 showed no change of Zr concentration. Any variation in mechanical properties was that caused by ordinary enlargement of the grain. (J.S.R.)

5992

THE EVOLUTION OF THE ELECTRICAL RESISTANCE OF COLD-WORKED "MELTED ZONE" ALUMINUM DURING ANNEALING AT −79°C. Omourtague Dimitrov and Philippe Albert. Compt. rend. 245, 2275-7(1957) Dec. 16. (In French)

A study of the annealing of "zone-melted" Al at −79°C was made on three samples cold-worked in different ways. One sample was cold-worked at 20°C and then placed in liquid nitrogen immediately after the cold-working. The resistance was measured and it did not vary even after annealing for 100 hours at −79°C. The second sample was cold-worked at −18°C and then placed in liquid nitrogen. Annealing at −79°C first causes a rapid increase in the resistance, but it soon reaches a constant value which further annealing does not affect. The third sample was cold-worked at the temperature of liquid nitrogen. The resistance increases rapidly as a function of the annealing time at −79°C. Recrystallization appears after 100 hours of annealing. No crystallization was noticed in the other samples. (J.S.R.)

5993

X-RAY STUDY OF COLD WORK IN MOLYBDENUM. J. Despujols and B. E. Warren (Massachusetts Inst. of Tech., Cambridge). J. Appl. Phys. 29, 195-7(1958) Feb.

Filings from a molybdenum rod, pressed into a briquet, were used as the cold worked sample. Satisfactory peak shapes for 110, 200, 211, 220, and 310 were obtained with filtered CuKα. Peak shapes for 400 and 422 obtained with filtered MoKα were not satisfactory, partly because of fluorescence radiation. Peaks were recorded with a Norelco diffractometer, and instrumental broadening corrected by the Stokes method. The Fourier coefficients indicate approximately isotropic incoherent domains L = 260 A, and strains inversely as Young's modulus. Molybdenum is similar to tungsten in that there is no evidence for faulting on (211) as a result of cold work. (auth)

5994

HEATS OF FORMATION OF LIQUID ALLOYS AT 1100° BY A SIMPLE REACTION CALORIMETER. R. A. Oriani and W. K. Murphy (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem. 62, 199-202(1958) Feb.

The design and operation of a simple, high-temperature reaction calorimeter capable of ±10% accuracy are described. The enthalpies of formation at 1100° of liquid silver–gold, silver–copper, and gold–nickel alloys from their liquid components have been measured. The results show that there exists a strong similarity between the interactions in the liquid solution and those in the solid solution. (auth)

5995

MAGNESIUM AND ITS ALLOYS. APPLICATIONS IN NUCLEAR ENGINEERING. T. J. Heal (United Kingdom Atomic Energy Authority, Eng.). Nuclear Eng. 3, No. 22, 52-61(1958) Feb.

The physical, chemical, and mechanical properties of Mg and Mg alloys for nuclear engineering applications are reviewed. Tables and graphs are included. (J.E.D.)

5996

MASS TRANSFER IN LIQUID METAL SYSTEMS. 1. THERMAL GRADIENT TRANSFER. J. W. Taylor (Babcock and Wilcox, Ltd.). Nuclear Power 3, 53-7 (1958) Feb.

Mass transfer in liquid metal systems occurs by thermal gradient transfer or isothermal transfer. In liquid-metal systems having a temperature differential, mass transfer of the container material may result in failure of the hot limb component or stoppage of the flow because of precipitation in the cold limb. Experimentally this transfer may be studied in thermal or forced convection conditions. The basic steps of the transfer process are solution of the container components and precipitation at the cold limb. The kinetics of dissolution and the parameters influencing it have been studied and the results are reviewed. Less is known about the kinetics of the second process. (J.S.R.)

5997

REACTOR-GRADE ZIRCONIUM METAL. Nuclear Power 3, 73-4(1958) Feb.

The facilities and techniques used at the Sheffield works of Wm. Jessop and Son Ltd. for the production of reactor-grade Zr are described. (J.S.R.)

5998

INERT-GAS-SHIELDED CONSUMABLE-ELECTRODE WELDING OF MOLYBDENUM. N. E. Weare, R. E. Monroe, and D. C. Martin (Battelle Memorial Inst., Columbus, Ohio). Welding J. (N. Y.) 37, 117s-24s(1958) Mar.

As part of an over-all program to improve the ductility

of molybdenum weldments, studies were initiated to adapt the inert-gas-shielded consumable-electrode arc-welding process to molybdenum. This paper covers the work required to improve metal transfer and arc stability in molybdenum arcs before starting complete evaluation of this welding process. Arc stability and metal transfer could be improved to the greatest extent by using d-c, straight polarity, an electrode wire coated with a compound to increase the emission of electrons, and a helium shield. These same conditions also produced the best weld-bead contour, and lessened the amount of weld-metal cracking due to shrinkage stresses developed in the weldment. Porosity was not evident when using either a leading-trailing shield or a dragging shield, and when welding on arc-cast molybdenum. Metallographic and bend-test comparisons were made between these welds and tungsten-arc welds in $\frac{1}{8}$-in. thick molybdenum. The weld-metal grain size was about the same for both weldments. Room-temperature bend-test ductility was very low for both weldments. The results of this comparison indicated that the inert-gas-shielded consumable-electrode welding process may have its best application in welding thick molybdenum plate, whereas tungsten-arc welding would be better for welding sheet $\frac{1}{8}$-in. thick or less. (auth)

5999

NUCLEAR METALLURGY. VOL. IV. A SYMPOSIUM ON URANIUM AND URANIUM DIOXIDE. IMD Special Report Series No. 4. New York, The Metallurgical Society of American Institute of Mining, Metallurgical, and Petroleum Engineers, 1957. 146p. $7.00.

This volume contains the papers presented at a Symposium on the fabrication of U and the preparation and fabrication of UO_2 for fuel element use held at the IMD Fall Meeting, Morrison Hotel, Chicago, November 6, 1957. The titles of the papers are: "Development of Casting Techniques for Uranium and Uranium Alloys," "Uranium Ingot Production at Atomic Energy Commission Feed Material Production Centers," XXX "Induction Melting of Uranium Base Alloys," "Melting and Casting of Uranium, Zirconium, Niobium Alloys," "Centrifugal Casting of U–Zr Alloy Rods," "Injection Casting of Uranium–Fissium Alloy Pins," "Arc Melting of Uranium-Rich Alloys," "Press Forging of Dingot Uranium," "Rolling of Uranium," "Extrusion of Uranium," "Cold Working of Uranium," "Fusion Welding of Uranium," "Powder Metallurgy of Uranium and Uranium Alloys," "Various Methods of Preparing Uranium Dioxide for Fuel Element Use," "Fabrication of Bulk Form Uranium Dioxide for Use as Nuclear Reactor Fuel," and Fabrication of High-Density Uranium Dioxide Fuel Components for the First Pressurized Water Reactor Core." (J.S.R.)

PHYSICS

6000 AECU-3445

Sandia Corp., Albuquerque, N. Mex.

VOLUME RESISTANCE-TEMPERATURE CHARACTERISTICS OF PZT (53% LEAD ZIRCONATE AND 43% LEAD TITANATE COMPOSITION BY MOLECULAR WEIGHT). Martin A. Uman. Aug. 31, 1956. 14p. Contract [AT 29-1)-789]. (TM-173-56-14). $3.30(ph OTS); $2.40(mf OTS).

This paper provides information as to the variations in volume resistance of PZT with temperature over a temperature range from −41°F to 500°F. Accompanying the qualitative explanation of methods and results is a graphical display of the resistance-temperature phenomena. Evidence is presented to prove that the measured volume resistance variations are not caused by surface resistance, but rather by inherent physical properties of the piezoelectric material. (auth)

6001 AECU-3447

Sandia Corp., Albuquerque, N. Mex.

NORMAL INCIDENCE REFLECTION OF DIPOLE RADIATION FROM A PLANE INTERFACE. R. K. Moore. Sept. 7, 1956. 11p. Contract [AT(29-1)-789]. (TM-199-56-14). $3.30(ph OTS); $2.40(mf OTS).

The problem of reflection of a spherical (dipole) electromagnetic wave from a smooth plane is solved, showing that the "radiation field" is reflected with the plane wave reflection coefficient. A more complicated expression describes reflection of the "induction field." This means that, for those cases where the earth is smooth enough for specular reflection, the plane wave reflection coefficient may be used in calculating radar altimeter returns. (auth)

6002 AECU-3450

Sandia Corp., Albuquerque, N. Mex.

HIGH-EXPLOSIVE ARGON FLASH LIGHT SOURCE. J. Todd, Jr. and D. Parsons. [Jan. 11, 1957]. 13p. Contract AT-(29-1)-789. (TM-229-56-52).

An HE argon extremely high-intensity flash system has been developed for use in test vehicles released from high altitudes. This flash system allows the use of nontracking-type plate cameras during daylight operations. (auth)

6003 AECU-3637

Oak Ridge Gaseous Diffusion Plant, Tenn.

ADSORPTION FROM SOLUTION METHODS FOR SURFACE AREA MEASUREMENT. G. F. Mills. Jan. 20, 1958. 4p. (KLI-4299).

The analytical procedures for wet adsorption methods for surface area measurements are described. (J.S.R.)

6004 AFOSR-TR-57-85

Illinois Inst. of Tech., Chicago.

FUNDAMENTAL PROCESSES OF FRICTIONAL WEAR IN ALKALI HALIDE CRYSTALS. P. L. Copeland and E. Zwicker. Oct. 1957. 81p. Contract AF18(600)-643. (AD-136675).

Friction and wear between single crystals of LiF was extensively investigated. The mechanism proposed to explain the features of metallic friction was found to apply also to friction in LiF. This mechanism was particularly successful when applied to explain the characteristics of the special fractures of triangular shape named "deltas" which were formed in (100) surfaces. The presence or absence of a dislocation layer in the surface of LiF was found to effect the character of the deltas. The roughness of the surfaces also had an effect on the deltas. The alkali halides LiF, NaCl, KCl, and KBr were compared in friction and wear, and a significant trend was found in the wear features which appeared to show dependence on cohesive energies and ion sizes of the crystals. Electropolished Cu single crystals in friction with Si and brass displayed a peculiar dependence of coefficient of friction on load. No wear was detected in the case of Cu on Si. Electropolished single crystals of Cu and Ni on polycrystalline Zn behaved as might be expected, showing a small but steady decrease in coefficient of friction with load which is often observed in a wearing in process. (auth)

6005 CF-58-2-76

Oak Ridge National Lab., Tenn.

COMMENTS ON THE ANGLE OF REPOSE OF AQUEOUS ThO_2 SLURRIES. D. G. Thomas. Feb. 14, 1958. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Questions about the angle of repose of settled beds of

aqueous thorium oxide slurries have arisen in connection with the design of the lower portion of the blanket pressure vessel and its associated piping. The literature review on the angle of repose of various dry solids by Mrs. B. S. Neumann in J. J. Hermans' book on "Flow Properties of Dispersed Systems" is summarized. Mrs. Neumann points out that both a dynamic and static angle of repose have been observed with the angles for dynamic systems being larger than for static systems. Results are reported for two different types of experiments with slurry discharged from run 200A-14 which gave static angles of repose of 45 to 50° and dynamic angles of 65 to 75°. (auth)

6006 MT-33

National Research Council of Canada. National Research Labs., Ottawa.

AN INVESTIGATION OF THE WETTABILITY OF URANIUM DIOXIDE BY BISMUTH AND BISMUTH ALLOYS. P. G. Hill and E. H. Dudgeon. Dec. 19, 1956. 24p.

An examination has been made of the factors involved in the wetting of solids by liquid metals. It indicates that the wetting of UO_2 by liquid Bi might be considerably improved by the addition of small quantities of alkali metals to the Bi. Experiments indicate that the addition of 5 to 10% by weight of Na is required to produce sufficient wetting of UO_2 to allow formation of a Bi–UO_2 slurry. (auth)

6007 AEC-tr-3158

FUSION AND SELF-DIFFUSION IN SOLID METALS. K. A. Osipov. Translated by V. N. Rimsky-Korsakoff from Izvest. Akad. Nauk S.S.S.R., Otdel Tekh. Nauk, No. 7, 35-40(1957). 13p.

6008 NP-tr-44

ON THE LUMINESCENCE OF HIGH POLYMER SUBSTANCES. [PART] II. H. Hinrichs. Translated from Z. Naturforsch. 9a, 625-30(1954). 7p.

During the cathode-ray excitation of fluorescing substances embedded in polystyrene, the fluorescence intensity decreases exponentially with the number of the electrons which have reached the target. With hydroquinone-dicarbonic acid-diethyl ester, a negative dependence for the decomposition constant of the concentration of fluorescing material was observed, and it is supposed that this effect is caused by energy transfer. The decomposition of crystalline substances is compared with that of the substance in polystyrene solution. (auth)

6009 NP-tr-48

TEMPERATURE MEASUREMENT WITH A GRAPHITE–TUNGSTEN THERMOCOUPLE. E. A. Galileeva. Translated by P. Collins from Teploenergetika 3, 62-3(1956). 5p.

The use of graphite–tungsten thermocouples for temperature measurements under both laboratory and production conditions, and also special experimental trials of these thermocouples, showed that the possibility of measurement of temperatures was greater than 1600°C. The type and degree of graphitation of the C electrode rods used in the preparation of the thermocouple influence the uniformity of the emf curve of a graphite–tungsten thermocouple and also the constancy of the emf. To obtain constant emf from a graphite–tungsten thermocouple, preliminary heating in a jacket at 1600°C for one hour is recommended. For protracted use the thermocouple should be enclosed in a jacket of refractory material to prevent burning. (auth)

6010 SCTM-224-57(51)

Sandia Corp., Albuquerque, N. Mex.

SOME EXTENSIONS TO THE THEORY OF EXPLOSIVE-ELECTRIC TRANSDUCERS. G. W. Anderson. Aug. 23, 1957. 69p. Contract AT(29-1)-789. $10.80(ph OTS); $3.90(mf OTS).

Neilson's theory of ferroelectric and ferromagnetic explosive-electric transducers is extended to cover materials with more realistic hysteresis loops. Calculations of some special cases are presented to illustrate typical circuit behavior. (auth)

6011

THE INTERACTION BETWEEN THE α PARTICLE AND THE PROTON IN THE MOLECULE $Po^{218}H_2$. Dragoliub K. Yovanovitch. Compt. rend. 246, 746-8(1958) Feb. 3. (In French)

6012

ENERGY PRODUCTION FROM NUCLEAR FUSION REACTIONS. P. Caldirola. Energia nucleare (Milan) 5, 3-10 (1958). (In Italian)

The principles on which energy production from nuclear reactions is based are stated while conditions of a nuclear reactor operating on these principles are examined. After a brief review of the results reached up till now in the various laboratories of the world in this field of research, a hint is given to the possibility of a controlled harnessing of this new form of nuclear energy. (auth)

6013

SURFACE TENSION OF TITANIUM, ZIRCONIUM, AND HAFNIUM. A. W. Peterson, H. Kedesdy, P. H. Keck, and E. Schwarz (U. S. Army Signal Engineering Labs., Fort Monmouth, N. J.). J. Appl. Phys. 29, 213-16(1958) Feb.

The surface tensions of liquid Ti, Zr, and Hf at their melting points were measured in pure argon atmosphere by the drop-weight method. A uniform longitudinal field induction coil was used to melt the sample rod tip. The average values obtained were 1390 ± 40, 1400 ± 40, and 1460 ± 40 dynes/cm, respectively. (auth)

6014

NUCLEAR POWER FOR ROCKETS. L. R. Shepherd. New Scientist 3, No. 66, 29-31(1958) Feb. 20.

The potentialities of nuclear propulsion for rockets are explored. A serious study of the problem of applying nuclear energy to rockets must start with the assumption that the nuclear fuel must be "watered down," that is, the rocket must carry not only the nuclear fuel but also an inert propellant or working fluid which will absorb the energy released by the nuclear reaction and will form the bulk of the material ejected in the propulsive jet. A thermalnuclear process, closely analogous to the conventional chemical rocket, and an electromagnetic process, in which the fluid is ionized and accelerated as a beam or plasma jet, are discussed. The first method appears to have the earliest hope of success. (J.S.R.)

6015

THERMONUCLEAR POWER. ZETA SHOWS WAY AHEAD. FOUR-STAGE DEVELOPMENT EXPECTED. Nuclear Power 3, 50-2(1958) Feb.

A brief description of the design of the ZETA and SCEPTRE III are given. Both instruments appear to have initiated thermonuclear reactions, but some doubt still remains as to the origin of the neutrons detected. The objectives of the thermonuclear program in Great Britain are outlined. Progress made in the U. S. is briefly indicated. (J.S.R.)

6016

ENERGY EXCHANGE BETWEEN ELECTRON AND ION GASES THROUGH COULOMB COLLISIONS IN PLASMAS. A. A. Dougal and L. Goldstein (Univ. of Illinois, Urbana). Phys. Rev. 109, 615-24(1958) Feb. 1.

The general aspects of energy exchange among the electron, ion, and molecule constituent gases, and their

energy transfer to the boundary, are examined for a partially ionized gas. Coulomb collisions between electrons and ions are identified to contribute significantly to thermal energy transfer from the electron gas, even in very weakly ionized gases. Experiments were performed to determine the time required for electron temperature deviations from equilibrium to return to equilibrium with the ion and molecule temperature. The method of guided microwave interaction within the plasma was employed for selectively heating the electron gas to increments above that of the ion and gas temperatures, and for sensing the subsequent electron temperature deviations through the electrical conductivity of the plasma. In addition, phototube detection of the plasma luminous intensity is employed to detect electron temperature deviations. The experimental results show that energy exchange between electron and ion gases is predominant in the experimental plasmas, under appropriate conditions, where the ionization is less than 0.001%. In a plasma produced in neon gas at 2.25 mm Hg, 300°K, the characteristic time for equipartition of excess mean electron energy with the ion gas varies from 11 to 5 μsec as the ion concentration increases from 1.6 to 5.8×10^{11} per cm^3. These times are much shorter than the 160 μsec which would be required for the electron temperature to return to equilibrium in the absence of Coulomb collisions. The expected behavior with respect to ion concentration and ion mass is confirmed, but an anomaly with respect to electron temperature is found. (auth)

4017

ELECTRON-ELECTRON INTERACTION AND HEAT CONDUCTION IN GASEOUS PLASMAS. L. Goldstein and T. Sekiguchi (Univ. of Illinois, Urbana). Phys. Rev. 109, 625-30(1958) Feb. 1.

The phenomenon of heat conduction in gaseous plasmas is observed in order to explore the problem of the mutual electron interaction. In addition to the technique of interaction of pulsed microwaves in decaying plasmas, the phenomenon of "afterglow quenching" is exploited in the experiments. The experimental values of the thermal conductivity, in low-gas-pressure neon and xenon plasmas of adequately high charge density, are determined by two different methods. They have been found to be of the order of $10^{-4}-10^{-5}$ (joules/cm sec degree) for the electron density range $10^{11}-10^{13}$ (cm^{-3}) at room temperature (~300°K). The most significant result of these experiments is that the thermal conductivity in the plasmas described is chiefly determined by heat flow in the electron gas of the plasma. Thus the mutual interaction of the electrons plays a predominant role in the phenomenon of heat conduction. The experimentally obtained values of the thermal conductivity are in agreement within less than one order of magnitude with those given by the theory of Spitzer and Härm. (auth)

4018

THE GAMMA-RAYS FROM MUON CATALYSED FUSION OF HYDROGEN AND DEUTERIUM. A. Ashmore, R. Nordhagen, K. Strauch, and B. M. Townes (Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 161-72(1958) Feb.

The fusion of hydrogen and deuterium catalyzed by muons was observed by Alvarez et al. Events were seen in a bubble chamber in which the muon was re-emitted with the energy released in the fusion process. In the experiments described here the γ rays from the fusion were detected and a measurement made of their time distribution. The yield of γ rays was found to be 0.34 ± 0.06 per muon stopping in liquid hydrogen enriched with 1.8% of deuterium. A comparison with the results of Alvarez et al. gives an internal conversion coefficient of 0.066 ± 0.014. The analysis of the time distribution enables the following limits to be set on the two reaction rates involved: $0.19 \times 10^6\ sec^{-1} < \lambda_{slow} < 0.88 \times 10^6\ sec^{-1}$ and $0.55 \times 10^6\ sec^{-1} < \lambda_{fast} < 2 \times 10^7\ sec^{-1}$. A comparison with theory shows that it is not possible to assign them to particular processes in the chain of events following a muon stopping in the enriched mixture. (auth)

4019

THEORY OF LIQUID He^3. S. K. Trikha (Delhi Univ., India). Progr. Theoret. Phys. (Kyoto) 18, 1-22(1957) July.

Following London (1939) in the case of liquid He^4, a theory of liquid He^3 has been developed. Liquid He^3 is described by picturing it as a metal in which the ions and the electrons are replaced by particles of the same kind viz. He^3 atoms. A fraction of the total number of atoms corresponds to the free electrons in the metal and behaves as an ideal F. D. gas in a potential well, while the rest of the atoms constitute a quasi-crystalline lattice. Agreement between theory and experiment concerning the specific heat, entropy, vapor pressure and nuclear spin magnetic susceptibility (and its variation with pressure) is found to be satisfactory. (auth)

Cosmic Radiation

4020

DIRECTIONAL MEASUREMENTS OF THE DAILY VARIATION OF COSMIC RAY MESON INTENSITY AT λ = 73°S. N. R. Parsons (Univ. of Tasmania, Hobart). Australian J. Phys. 10, 462-70(1957) Dec.

Measurements are reported of the daily variations of meson intensity at Mawson, Antarctica (λ = 73°S), recorded by counter telescopes inclined at 45° to the vertical in each of north, east, south, and west directions. The results, together with those from a vertical telescope, are examined and found to be inconsistent with an assumed common origin of the different directional variations in the interaction of an anisotropic primary radiation with the Earth's dipole field. (auth)

4021

LOGARITHMIC REPRESENTATION OF COSMIC-RAY INTENSITY. Masami Wada. J. Sci. Research Inst. (Tokyo) 51, 201-10(1957) Dec.

To evaluate the quantities which indicate the variational amounts relative to the mean of cosmic-ray intensity, the use of natural logarithm is examined. While a standard unit is required to be determined for the relative intensity when represented by ordinary percentage value, it is not needed for the logarithmic indication. Several advantages due to the use of logarithms are described. (auth)

4022

THE FORMATION OF ^{22}Na FROM ATMOSPHERIC ARGON BY COSMIC RAYS. L. Marquez, N. L. Costa, and I. G. Almeida (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Nuovo cimento (10) 6, 1292-5(1957) Dec.

It was found that Na^{22} is formed as a spallation product of atmospheric argon by cosmic rays. It was isolated from the fresh rain water of Rio de Janeiro, and its average activity is 0.017 dpm/l. (auth)

4023

ON THE CORRECTION OF THE INTENSITY OF COSMIC RAYS AT SEA LEVEL BY MEANS OF ATMOSPHERIC DATA. U. Fasoli and J. Pohl-Rüling (Istituto di Fisica dell'Università and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 6, 1339-55(1957) Dec.

Various correlations have been investigated between the total intensity of cosmic rays and the meteorological

factors of the atmosphere. These measurements have been carried out at Padua using three different sets of apparatus. An analysis is made of the atmospheric data, and the effect of the seasonal variation on the correlation coefficients is discussed. (auth)

6024

ON THE NUCLEON-NUCLEON INTERACTION WITH ENERGY HIGHER THAN 10^{14} ev. P. Ciok, M. Danysz, J. Gierula, A. Jurak, M. Miesowicz, and J. Pernegr (Institute of Nuclear Research, Warsaw) and J. Vrána and W. Wolter (Physical Inst. of the Czechoslovak Academy of Science, Prague). Nuovo cimento (10) 6, 1409-15(1957) Dec.

A jet $0 + 14\alpha$ of the energy $3.3 \cdot 10^{14}$ ev is described. It was found that the distribution of charged particles is asymmetric in center of mass system but becomes symmetric when the neutral particles have been taken in consideration. The information about the neutral particles was obtained from the development of the electronic component of the shower. The angular distribution in center of mass system is strongly anisotropic and near to Heisenberg's distribution. The energy of the secondary particles in center of mass system is of the order of a few Bev and transversal momenta given for two secondaries are of the order of several hundred Mev/c. The inelasticity coefficient is ~ 0.1. (auth)

6025

STATISTICAL FLUCTUATIONS OCCURRING IN ELECTRON-PHOTON CASCADES OF 1000 Bev PRIMARY ENERGY. H. Fay (Max-Planck-Institut für Physik, Gottingen, Germany). Nuovo cimento (10) 6, 1516-19(1957) Dec.

6026

THE RELATION BETWEEN THE NUMBER OF SHOWER PARTICLES AND THE ATOMIC NUMBER OF A DISINTEGRATING NUCLEUS. Zh. S. Takibaev (Physico-Tech. Inst., Academy of Sciences, Kazakh, SSR). Soviet Phys. (Doklady) 2, 265-8(1957) May-June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 12772.

6027

ON THE ENERGY SPECTRUM INDEX OF THE PENETRATING COMPONENT IN WIDE ATMOSPHERIC SHOWERS WITH A FIXED NUMBER OF PARTICLES. R. E. Kazarov and E. L. Andronikashvili (Inst. of Physics, Georgian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1528-30(1957) Dec. (In Russian)

The energy spectrum of the penetrating component was studied at an elevation of 400 m above sea level, near Tiflis, at 61, 127, and 162 mwe. The mean number of shower particles was 2.9×10^5. The number of particles was determined with an accuracy up to ±50%. The energy spectrum for penetrating particles in a wide shower with 28 m mean distance from axis had an index $\gamma = 1.09 \pm 0.21$. (R.V.J.)

6028

THE TRANSITION EFFECT OF STARS IN LEAD ABSORBER. T. V. Varsimashvili and N. I. Kostanoshvili (Inst. of Physics, Georgian S.S.R.). Zhur. Eksptl'. i Teoret Fiz. 33, 1530-1(1957) Dec. (In Russian)

Crystallography and Crystal Structure

6029 AECU-3638

Oak Ridge Gaseous Diffusion Plant, Tenn.

QUANTIZATION OF CRYSTAL VIBRATIONS. W. C. DeMarcus. July 26, 1957. 14p. Contract [W-7405-eng-26]. (KOA-295). $3.30(ph OTS); $2.40(mf OTS).

Although the Born-von Karman treatment of the dynamics of crystal lattices is superior to that of Debye, the continuum model of Debye is more amenable to computation; therefore the Debye treatment is used to obtain frequencies at a maximum energy. From the classic Hamiltonian of the solid, quantization is carried out by the Schroedinger method. The thermodynamic functions are obtained, and the mean square displacement is derived. (J.S.R.)

6030

CRYSTAL FIELD EFFECTS IN METALS. R. S. Leigh (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Phys. Soc. (London) 71, 33-7(1958) Jan.

The errors made in calculations of one-electron energy levels in metals are estimated by using a potential which is spherically symmetric inside the inscribed spheres of the atomic polyhedra and constant between these spheres. An idealized case is considered in which the true crystal potential may be regarded as the sum of the electrostatic potentials of non-overlapping ion cores and a uniform neutralizing distribution of electrons. Only body-centered and face-centered cubic lattices are considered. (J.S.R.)

Electrical Discharge

6031

HIGH FREQUENCY DISCHARGE IN GAS AT LOW PRESSURES. EXPERIMENTAL STUDY OF HIGH FREQUENCY ION SOURCES. Jean Salmon. Ann. phys. 2, 827-80(1957) Nov.-Dec.

The theory of high-frequency discharge in gas at low pressures is investigated, and the distribution function of electrons present in the gas is calculated. The evolution of the electronic density at the center of the discharge tube is studied in attributing to the secondary emission from the walls of the tube an essential role in electron multiplication. The conditions of starting are obtained. In the second part a detailed description of an ion source functioning at 96.5 Mc/s is given, and measurements made on it and the search for a theoretical explanation of certain of its properties are discussed. A brief analysis of different types of high-frequency ion sources is given, along with their utilization in corpuscular microscopy and particle accelerators. (J.S.R.)

6032

ENERGETIC EVOLUTION OF A THERMONUCLEAR PLASMA OF DEUTERIUM. Émile Lacombe, Denyse Magnac-Valette, and Pierre Cüer. Compt. rend. 246, 744-6(1958) Feb. 3. (In French)

6033

ON THE PULSATIONS OF A PLASMA FILAMENT. A. G. Kulikovskii (M. V. Lomonosov Moscow State Univ.). Soviet Phys. (Doklady) 2, 269-72(1957) May-June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 12781.

Electrons

6034

MEASUREMENT OF THE POLARIZATION OF RELATIVISTIC ELECTRONS. Claude Bouchiat (Laboratoire Central des Poudres, Paris) and Louis Michel (Faculté des Sciences, Université de Lille). Nuclear Phys. 5, 416-34 (1958) Feb. (In French)

A covariant formalism for handling electron polarization is described, and it is shown how to use it in quantum field theory calculations. It is applied to the study of polarization effects in electron-electron collisions. These effects can be used for the measurement of the transverse and longitudinal polarization of relativistic electrons. (auth)

6035
DIRECT PRODUCTION OF ELECTRON PAIRS BY HIGH ENERGY ELECTRONS. MODEL OF FORMATION OF THE INITIAL TRACK OF ELECTRON PAIRS. ELIMINATION OF FAKE TRIDENTS. R. Weill, M. Gailloud, and Ph. Rosselet (Laboratoire de Recherches Nucléaires, E. P. U. L., Lausanne, Switzerland). Nuovo cimento (10) 6, 1430-44(1957) Dec. (In French)

The mean free path for direct electron pair production by electrons has been measured in the energy region 2 to 8, 8 to 32, and 32 to 150 Bev. The obtained values are less than those foreseen by Bhabha's theory. The disagreement is not imputable to energy underestimations. A three dimensional model of track formation in nuclear emulsion which accounts for the ionization variation observed at the beginning of electron pairs of more than ten Bev is described. This indicates that energy determinations using methods described in a previous paper are correct while energies evaluated on the basis of dipole effect theory can be overestimated by 100 times. The number of unresolvable bremsstrahlung pairs produced on the track of an electron of known path and energy has been calculated. Errors inherent to Koshiba and Kaplon's method are thus eliminated. (auth)

6036
CHARACTERISTIC ENERGY LOSS OF ELECTRONS IN GRAPHITE. Yoshi H. Ichikawa (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 109, 653-7(1958) Feb. 1.

The problem of analyzing the characteristic energy loss of electrons in solids is discussed in some detail. Based on the general discussion developed, the observed 7.5-ev loss line of graphite is tentatively identified as due to the collective excitation of π electrons. The theoretical analysis gives results which strongly favor this identification. Furthermore, it has been shown that the present theory together with detailed experimental studies is very useful for the determination of the π-electron band structure of graphite. (auth)

6037
DISTRIBUTION FUNCTIONS FOR A CLASSICAL ELECTRON GAS. S. V. Tiablikov and V. V. Tolmachev (V. A. Steklov Mathematics Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 299-302(1957) May-June.

Effective methods of constructing the binary distribution function (the radial distribution function) for gases in statistical equilibrium have been proposed by Bogoliubov. However, at small distances the Bogoliubov expansion becomes negative. Methods of improving the convergence at small distances are given. (J.S.R.)

Gases

6038
IONIZATION YIELD OF PROTONS IN NITROGEN AND ARGON. Ralph A. Lowry and Glenn H. Miller (Iowa State Coll., Ames). Phys. Rev. 109, 826-31(1958) Feb. 1.

The total ionization yield of protons in nitrogen and argon gases was studied for energies in the range of a few to 250 kev. A large cylindrical ionization chamber was used for this study. The chamber was alternately operated as a proportional counter and an ionization chamber to measure the rate with which the protons entered the chamber and the total ionization produced by them, respectively. The results indicated a straight-line relation between the ionization yield and proton energy for energies above 75 kev in nitrogen and above 25 kev in argon. Straight-line plots of the data had slopes corresponding to 36.6 ± 0.7 ev per ion pair for nitrogen and 26.5 ± 0.5 ev per ion pair for argon. For argon the straight-line plot intercepted the energy axis at 1.4 ± 0.9 kev, indicating a slight ionization defect. (auth)

6039
THE DIELECTRIC ORIENTED POLARIZATION OF GASES. H. K. Wimmel and W. Maier (Institut für Physikalische Chemie der Universität, Freiburg i.Br.). Z. Naturforsch. 13a, 48-9(1958) Jan. (In German)

Instruments

6040 AECU-3415
Sandia Corp., Albuquerque, N. Mex.
PRELIMINARY STUDY OF THE PRESSURE TRANSDUCER PROJECT. A. J. Eldridge. Aug. 6, 1956. 13p. Contract AT(29-1)-789. (TM-144-56-16). $3.30(ph OTS); $2.40 (mf OTS).

A feasibility study is presented of the application of several commercially available pressure transducers for incorporation in a dynamic baro-switch tester or for use in a baro-switch application. (auth)

6041 AECU-3443
Sandia Corp., Albuquerque, N. Mex.
ENERGY TRANSFORMERS WITH n SECONDARIES. E. F. Schroeder. July 18, 1956. 45p. Contract [AT(29-1)-789]. (TM-148-56-14). $7.80(ph OTS); $3.30(mf OTS).

A general solution is given to the problem of obtaining a maximum transfer of energy from a single pulse of DC with a transformer having n secondaries. A specific application for such a transformer is to fire squib matches, especially those with low-resistance bridge wires. Other considerations that affect the output energy are discussed, and a simple design is presented in the appendix. (auth)

6042 AECU-3444
Sandia Corp., Albuquerque, N. Mex.
PRINTED CIRCUIT METHODS AND APPLICATIONS. Donald A. Loren. Sept. 10, 1956. 25p. Contract [AT(29-1)-789]. (TM-165-56-14). $4.80(ph OTS); $2.70(mf OTS).

Various techniques for producing printed circuits are described, along with their advantages, disadvantages, and applications. Emphasis is placed upon an etched foil method. (auth)

6043 AECU-3449
Sandia Corp., Albuquerque, N. Mex.
A 10-MEGACYCLE TRANSISTOR BINARY COUNTER. Dennis Holliday. Sept. 19, 1956. 21p. Contract [AT(29-1)-789]. (TM-242-56-14). $4.80(ph OTS); $2.70(mf OTS).

A binary counter circuit operating at input frequencies beyond 10 megacycles was developed using the new Philco L5122 (2N240) surface barrier transistors. (auth)

6044 AERE-N/M-26
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A VARIABLE GAIN D.C. AMPLIFIER. G. J. Fergusson. Oct. 8, 1948. 6p.

A variable gain d-c amplifier developed for making measurements over a range of ionization current of 15,000:1 is described. Only one high input resistance is used and the sensitivity is changed by alteration of the percentage feedback of the amplifier. (auth)

6045 HW-52915
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A SQUARE-WAVE POLAROGRAPH. R. E. Hamm. Oct. 7, 1957. Decl. Feb. 4, 1958. 27p. Contract W-31-10[9]-eng-52. $4.80(ph OTS); $2.70(mf OTS).

An improved square-wave polarograph circuit has been

developed and tested with solutions of copper, lead, cadmium, indium, and uranium in nitrate, chloride, and citrate media. An equation is proposed which fits the polarographic curves and the instrument was shown to have the theoretical resolution. In addition, the curves are independent of both the gate width and the mercury column head. The polarographic results were linear for cadmium and lead (two-electron reductions) in the range of 2×10^{-6} to 1×10^{-4} molar, and for uranium and iron (one-electron reductions) in the range of 1×10^{-5} to 4×10^{-4} molar. The possibility of remote application for "hot lab" and in-line analysis was checked and it was found possible to operate the polarograph at distances of at least 200 feet from the polarographic cell. (auth)

6046 IGR-R/CA-201(D)
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
MONITOR FOR WATER VAPOUR IN CARBON DIOXIDE. C. D. Reid, K. W. Paget, and J. W. Hill. Dec. 1957. 17p.

A review is made of the duties of a hygrometer working as a water-vapor monitor for the CO_2 coolant of the Calder Hall type of reactor. Of the types of hygrometer considered for this application, only the Infra-Red Gas Analyzer proved suitable. The performance of the Infra-Red Gas Analyzer as manufactured can be improved by a slight modification, details of which are given. This modified instrument is considered to be the more acceptable for the plant application. (auth)

6047 NAVORD-5756
Naval Ordnance Lab., White Oak, Md.
A COMBINED SIMPLE AND ELECTRO-MECHANICAL R.M.S. LINE-VOLTAGE REGULATOR. Albert D. Krall, George Schohan, and Walter H. Raskin. Nov. 4, 1957. 20p.

A 115 volt, 60 cycle, 1 kilowatt R.M.S. voltage regulator is described which provides protection against sudden large changes in line voltage. The regulator is capable of instantaneous correction to within 2% for sudden voltage changes of +10% and −20%. Regulation to within ±0.25% is obtained for voltage, frequency, and load changes after a delay of a few seconds. The regulator consists of a motor-driven variable auto-transformer controlling a ferroresonant circuit and energized by a magnetic-amplifier servo system controlled by an R.M.S. lamp-bridge sensor. (auth)

6048 NLCO-713
National Lead Co. of Ohio, Cincinnati.
RECORDING THERMOGRAVIMETRIC BALANCE. F. M. Teetzel, M. A. Munroe, J. A. Williamson, A. E. Abbott, and D. J. Stoneking. Jan. 24, 1958. 19p. Contract AT(30-1)-1156. $0.75(OTS).

An instrument has been constructed that is capable of continuously recording the weight of a sample in a thermogravimetric balance during gas-solid reactions. This instrument automatically counterbalances a percentage of the weight change so that the balance deflection remains within the optical scale limits. Full-scale range of the recording device is easily changed to accommodate samples of various weight ranges. Accuracy and linearity have proved to be better than ¼%. (auth)

6049 SCTM-199-55(52)
Sandia Corp., Albuquerque, N. Mex.
APOTA (AUTOMATIC POSITIONING OF TELEMETERING ANTENNAS). James E. Palmer, T. V. Crawley, and J. T. Lannon. Sept. 14, 1955. 38p. Contract AT(29-1)-789. $1.25(OTS).

This report presents a description of and operating instructions for APOTA—a device which automatically tracks any signal-emitting source within the 190 to 250 Mc band. APOTA is especially useful for telemetering applications. (auth)

6050 SCTM-334-57(14)
Sandia Corp., Albuquerque, N. Mex.
ANALYSIS OF A FEEDBACK SYSTEM CONTAINING A GYROSCOPE. Thomas Hugh Martin. Jan. 3, 1958. 59p. Contract AT(29-1)-789. $9.30(ph OTS); $3.60(mf OTS).

This study analyzes a feedback system which consists of a gyroscope with a magnetized rotor spinning within a coil of wire. Because the equations for the motion of a gyroscope are nonlinear, certain assumptions were made to linearize the system for mathematical analysis. A servoloop was established using the Laplace transformation and a compensation system was designed to stabilize the servosystem. Limits of stability were found and an analog computer was used to check the various computations. Instabilities in the system caused by nonlinearities were corrected by interchange of error signals, a method suggested for any analog computations of circuit analysis. (auth)

6051 SCTM-340-57(14)
Sandia Corp., Albuquerque, N. Mex.
CONSTANT-CURRENT PULSE GENERATOR. H. R. Johnston. Jan. 10, 1958. 30p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

A constant-current pulse generator is described. The device is equipped with a transistorized constant-current pulse amplitude regulator which is driven by a monostable multivibrator. A feature of the equipment is a panel-mounted indicating meter which measures the time duration of the generated pulse. The amplitude of the pulse may be adjusted as a steady-state reading on a panel ammeter. The time duration of the pulse of this equipment may be adjusted from 1 to 3 milliseconds. The amplitude may be changed from 400 to 800 milliamperes. (auth)

6052 WAPD-TM-53(Add. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CANDLE — A ONE-DIMENSIONAL FEW-GROUP DEPLETION CODE FOR THE IBM-704. ADDENDUM 2. CANDLE 3. L. M. Culpepper. Oct. 1957. 3p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

6053 NP-tr-51
A NEW CONDUCTIVITY METER FOR CHEMICAL LIQUIDS. H. Boucke. Translated by F. Hudswell from Elektrom Wiss. u. Tech. 5, 5-7(1951). 9p.

6054
A PROTON SOURCE WITH LOW ARC VOLTAGE. Daniel Porte. Compt. rend. 245, 2233-6(1957) Dec. 16. (In French)

The design and operating characteristics of a low-voltage proton source are given. A Penning source is modified by the addition of a heated tungsten filament which is the primary ionizing electron source. The conditions of the arc discharge are discussed, and the characteristics of the ion beam are given. (J.S.R.)

6055
A GAMMA-SCATTERING SOIL DENSITY GAUGE FOR SUBSURFACE MEASUREMENTS. J. F. Cameron (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and M. S. Bourne (Soil Mechanics, Ltd., London). Intern. J. Appl. Radiation and Isotopes 3, 15-19(1958).

A gage for in situ measurements of soil densities with an accuracy of about 1 per cent which can be used at depths down to 1000 ft is described. A caesium-137 γ-ray source is separated by a cylindrical lead shield from a Geiger counter which detects the γ-radiation scattered by the soil. The optimum source-detector spacing is experimentally

determined. Pulses from the Geiger counter are fed along a cable to the scaling unit by means of a transformer impedance-matching circuit. A complete design and the method of calibration is given. (auth)

Isotope Separation

6056

THE TEMPERATURE DEPENDENCE OF THE ISOTOPE EFFECT IN THE ELECTROLYTIC DIFFUSION OF CHLORINE IONS IN MOLTEN THALLIUM(I) CHLORIDE. W. Herzog and A. Klemm (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 13a, 7-16(1958) Jan. (In German)

The mass effect μ (the relative difference of the diffusion rate/relative difference of the mass) for the electrolytic diffusion of chlorine ions in molten TlCl was measured in the temperature range $565° \leq T \leq 730°$. In the linear approximation $\mu = 0.077[1 - 0.00192(T-565)]$. The temperature dependence can be explained not by the temperature dependence of the isotope exchange equilibrium but perhaps by the increase of Cl dependence induced by increased temperature. In a 26-day investigation, by means of the Tl(anode)/TlCl/Tl(cathode) cell, the light isotope Cl^{35} was enriched from 75.4% in natural chlorine to 98.4% in the best test, which corresponded to a separation factor of 20. (tr-auth)

Mathematics

6057 AECU-3354

Sandia Corp., Albuquerque, N. Mex.

SOME PROPOSED RESEARCH ACTIVITIES PERTAINING TO RELIABILITY. R. O. Frantik. [Sept. 4, 1956]. 9p. Contract [AT(29-1)-789]. $1.80(ph OTS); $1.80(mf OTS).

It is proposed to outline the major problems in reliability research at Sandia, to note the progress made to date, and to generalize from experience. Much of the work is directed toward setting up machine methods for collecting, recording, and sorting data to feed into statistical studies in the evaluation of reliability. (M.H.R.)

6058 AECU-3632

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. STUDY PROGRAM ON HIGH-SPEED COMPUTER. PART II. SWITCHING CIRCUIT THEORY. PART III. MATHEMATICAL METHODS. PART IV. GENERAL RESEARCH. PART V. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Oct. 1957. 24p. Contracts AT(11-1)-415; N6ori-07130; and Nonr-1834(15). $4.80(ph OTS); $2.70(mf OTS).

6059 AECU-3634

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. STUDY PROGRAM ON HIGH-SPEED COMPUTER. PART II. MATHEMATICAL METHODS. PART III. GENERAL RESEARCH. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Nov. 1957. 20p. Contracts AT(11-1)-415; N6ori-07130; and Nonr-1834(15). $3.30(ph OTS); $2.40(mf OTS).

Basic circuits used on high-speed computers are described and control studies discussed. A program has been initiated to study iterative methods for solving systems of linear equations. A new and promising method of minimizing a function of n variables has been found, and a method applicable to evaluating determinants, solving linear algebraic equations, inverting matrices, and determining characteristic equations without round-off error is being tested. The Illiac use and operation for the November period are described. (J.S.R.)

6060 AECU-3635

Illinois. Univ., Urbana. Digital Computer Lab.

ON THE DESIGN OF A VERY HIGH-SPEED COMPUTER. Report No. 80. D. B. Gillies, R. E. Meagher, D. E. Muller, R. W. McKay, J. P. Nash, J. E. Robertson, and A. H. Taub. Oct. 1957. 250p. Contract AT(11-1)-415. $37.80(ph OTS); $11.10(mf OTS).

A summary of a study on the feasibility of constructing a computer about a hundred times faster than present computers using presently available components and techniques is presented. (W.L.H.)

6061 AECU-3640

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. SWITCHING CIRCUIT THEORY. PART III. MATHEMATICAL METHODS. PART IV. GENERAL RESEARCH. PART V. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Dec. 1957. 23p. Contracts AT(11-1)-415; N6ori-07130; and Nonr-1834(15). Dep.(mc); $4.80(ph OTS); $2.70(mf OTS).

Transistor circuits and control studies for high-speed computers are described. Combinational and distributive circuits are being investigated in relation to switching circuit theory. Mathematical methods were sought for determination of interval size in numerical integration of differential equations. A Monte Carlo Method for studying crystals is described. The use and operation of the Illiac during the month of December are presented. (J.S.R.)

6062 UCRL-3816

California. Univ., Berkeley. Radiation Lab.

A METHOD FOR MINIMIZING A FUNCTION OF n VARIABLES. William A. Nierenberg. June 21, 1957. 8p. Contract W-7405-eng-48. $0.50(OTS).

This is a method for finding the minimum of a function of an arbitrary number of variables by a series of successive approximations using a paraboloidal fit. The method is particularly suited for computer programming if a matrix inverting routine is available. (auth)

6063

ROTATIONAL PROPERTIES OF THE TWO-DIMENSIONAL ANISOTROPIC HARMONIC OSCILLATOR. I. EXPECTATION VALUES. H. J. Lipkin and S. Goldstein (Weizmann Inst. of Science, Rehovoth, Israel). Nuclear Phys. 5, 202-10(1958) Jan.

Expectation values are given for operators useful in unified model calculations with anisotropic harmonic oscillator wave functions. The operators chosen are of particular interest in regard to a description of the oscillator system in terms of collective and intrinsic coordinates. (auth)

6064

ON THE SYNTHESIS OF LINEAR SYSTEMS FOR THE PREDICTION OF RANDOM FUNCTIONS. Alejandro Medina (Instituto Nacional de la Investigación Científica). Rev. mex. fís. 6, 73-86(1957). (In Spanish)

The method recently developed by M. V. Cerrillo, for synthesis in the time domain using window distributions can be successfully used for transmission and prediction problems involving random functions. It is shown that for a stationary stochastic process subjected to certain restrictions, an adequate window distribution can be obtained providing an optimum filtering in the sense of the least square error. Two methods for the calculation of the areas of the windows are produced yielding two different types of approximations. In both cases the pertinent areas depend

on determinants whose coefficients can be calculated from an appropriate sampling of the correlation functions. (auth)

6065

ON THE USE OF WINDOW DISTRIBUTIONS FOR THE TRANSFORMATION OF STOCHASTIC FUNCTIONS. Alejandro Medina (Instituto Nacional de la Investigacón Cientifica). Rev. mex. fís. 6, 87-96(1957). (In Spanish)

In a previous paper, Cerrillo's method of synthesis using window distributions was applied to the filtering problem of a stochastic second order process, having a covariance Riemann integrable with respect to the impulse function (Green's function) of the system. In this work the foregoing results have been extended to a more general class of processes, namely those representing functions whose changes can be assumed to be a second order process. As is well known, such processess determine a measure in general, singular. Under the assumption that the Green's function of the system is integrable with respect to this measure in the Stieltjes sense, a window distribution can be found providing an optimum filtering. A difficulty arises in case the measure produces impulses, since then the assumption that the correlation functions are of slow variation with respect to the kernel cannot obviously be maintained. However, considering that such processes are mathematical idealizations that one could not expect to appear as such in actual experience, a simple method whereby the above mentioned difficulty can be circumvented is proposed. The result is that as long as it is possible to realize windows whose aperture can be considered as small relative to the correlation range of the actual physical process, such windows should operate successfully. (auth)

Measuring Instruments and Techniques

6066 AERE-Med/R-2455

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PERFORMANCE OF A PULSE AMPLITUDE ANALYZER TYPE 1414A FOR ROUTINE URINE ANALYSIS. W. P. Hutchinson. Nov. 1957. 13p. $0.45(BSI).

Preliminary experiments indicate that the slow Wilkinson "Kicksorter" may be used for routine urine analysis of alpha emitters. (auth)

6067 INS-TCA-10

Osaka Univ.

A STUDY OF THE HODOSCOPE CHAMBER. Shuji Fukui and Sigenori Miyamoto. Dec. 14, 1957. 16p.

Development is described of a radiation detection instrument which consists of parallel metal plates between which a number of glass tubes are inserted. Each tube is filled with a mixture of rare gases. When a strong electric current is applied to the plates immediately after the passage of a charged particle, the tubes of the trajectory of the particle are lighted. A schematic sketch of the chamber and a block diagram of the trigger circuit are included. Applications in the study of extensive cosmic showers are discussed. (C.H.)

6068

RADIATION PROTECTION CONTROL BY THE FILM DARKENING METHOD FOR PERSONNEL WORKING WITH RADIOACTIVE MATERIALS. H. Langendorff and F. Wachsmann. Atomkern-Energie 3, 60-4(1958) Feb. (In German)

An analysis of the use of the film-blackening method for the measurement of radiation shows it is suitable for the protection of personnel working with radioisotopes. The greatest value of this method, however, is that the kind of radiation, its energy, and the environmental conditions can be known within fixed limits. (J.S.R.)

6069

PRECISION CHARGE COMPARISON FOR THE STANDARDIZATION OF X-RAY DOSEMETERS. B. Worthley and M. J. Tooze (Univ. of Adelaide) and A. M. Thompson (C.S.I.R.O., Univ. Grounds, Sydney). Australian J. Appl. Sci. 8, 261-70(1957) Dec.

6070

THE ABSOLUTE STANDARDIZATION OF RADIOISOTOPES AT THE NATIONAL PHYSICAL RESEARCH LAB., PRETORIA, SOUTH AFRICA. J. K. Basson. Herdruk Uit Tegnikon 161-82(1957) Apr. (In Dutch)

6071

RADIATION POLYMERIZATION DOSIMETRY. F. E. Hoecker and I. W. Watkins (Univ. of Kansas, Lawrence). Intern. J. Appl. Radiation and Isotopes 3, 31-5(1958).

A high energy radiation dosimeter based on the radiation polymerization of a liquid is described. The proposed dosimeter has been used to obtain data in investigation of factors affecting the conversion of a liquid to a gel or solid by the use of x-ray and gamma rays. The proposed dosimeter utilizes a gelatin capsule as the container for the dosimetric liquid. It is very cheap to produce, may be discarded after use, and may be read without auxiliary equipment by untrained personnel. Data obtained with this instrument indicate that for intensities between 500 and 2500 r/min, the dose required for gelation is independent of dose rate. The data indicate that the gelation dose depends to some extent on the energy of the radiation and that gelation resulting from an intense dose of short duration is complete within 30 min after the dose is delivered. The particular dosimetric substance is stable over a long period in darkness and its response to radiation is not markedly dependent on temperature, although temperature effects have not been investigated over wide ranges. (auth)

6072

THE DAMAGE TO PLASTIC SCINTILLATORS BY IONIZING RADIATIONS. I. M. Rozman and K. G. Zimmer. Intern. J. Appl. Radiation and Isotopes 3, 36-42(1958).

The light intensity from plastic scintillators with a polystyrene base is diminished by an increased dose of the α- and β-radiation received. Moreover, the exposure is accompanied by a decrease in the transmission of the plastic scintillators' own luminescent light. This however is insufficient for quantitive explanation of the observed reduction in the intensity. The decrease in luminescent light yield is connected with radiation damage to the plastic scintillator. The α-radiation dose required to give 50 per cent damage in plastic scintillators is near 6×10^9 ergs/g, i.e. 50 times bigger than that required to damage equally single crystals of anthracene. (auth)

6073

ON THE USE OF PLASTIC SCINTILLATORS FOR DOSE MEASUREMENTS. I. M. Rozman and K. G. Zimmer. Intern. J. Appl. Radiation and Isotopes 3, 43(1958).

6074

SILICON CRYSTAL COUNTERS. W. D. Davis (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Appl. Phys. 29, 231-2(1958) Feb.

By doping silicon with impurities which produce energy levels deep within the forbidden region, resistivities of the order of 10^{15} ohm-cm may be obtained at liquid nitrogen temperatures. Single crystals of such material make excellent crystal counters. Some results obtained with gold-doped silicon are described. (A.C.)

6075
ON THE USE OF NUCLEAR EMULSIONS FOR MEASURING THERMAL-NEUTRON DENSITIES IN UNIFORM MEDIA. C. Beets and H. Breny (Centre d'Études des Applications de l'Énergie Nucléaire, Brussels). J. Nuclear Energy 6, 197-211(1958).

A detailed study has been made of the well known method using boron-loaded nuclear emulsions for measuring thermal neutron densities. It has shown that (a) the theory predicts a Poisson distribution for the number of tracks in any given field of observation; (b) this theoretical prediction is fairly well borne out by experiment; (c) when properly put to use, the nuclear-emulsion method is to be counted among the most reliable ones. (auth)

6076
THE USE OF LOW LEVEL GAMMA-RAY SPECTROMETRY IN THE FLUID OF NUCLEAR MEDICINE. L. D. Marinelli (Argonne National Lab., Lemont, Ill.). Minerva Nucleare 1, 201-7(1957) Oct.

6077
TELEMETERING SYSTEMS FOR POWER REACTORS. M. W. Jervis (AEI-John Thompson Nuclear Energy Co., Ltd.). Nuclear Power 3, 6-7, 10(1958) Jan.

The operating principles and a guide to their application are given for transducers used in reactor control. Directly operated and force balance instruments are discussed. The transmission media considered are pneumatic and electrical. Although capable of a high accuracy and reliability, pneumatic telemetering systems have a long time lag and less flexibility than the electrical systems. The force balance types offer better performance, but only with increased complication. (J.S.R.)

6078
THE ČERENKOV EFFECT PRODUCED BY SINGLE PARTICLES IN GASES. A. Ascoli-Balzanelli and R. Ascoli (Istituto di Fisica dell'Università and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 6, 1392-1408(1957) Dec.

The problem of the detection by means of photomultipliers of the Cherenkov radiation produced by single particles in gases is studied. It is shown that a high efficiency may be obtained with not too big detectors, provided that each pulse due even to one photoelectron may be detected. Experiments are described which show that such use of a photomultiplier is possible, and that an efficiency in agreement with the developed theory has been obtained with an 80 cm long detector filled with air at N.T.P. These experiments allow also a good determination of the number of emitted photons, and the result is in agreement with Tamm's theory. Some results obtained with freon 12 instead of air are also reported. (auth)

6079
A WF_6 BUBBLE CHAMBER. E. D. Alyea, Jr., L. R. Gallagher, J. H. Mullins, and J. M. Teem (California Inst. of Tech., Pasadena). Nuovo cimento (10) 6, 1480-5(1957) Dec.

A small bubble chamber has been constructed for testing corrosive, high-density liquids. Its successful operation with tungsten hexafluoride (WF_6) is described, together with some of the techniques necessary for handling this liquid and measurements of its physical properties. Some work on stannic chloride ($SnCl_4$) and stannic bromide ($SnBr_4$) is also summarized. (auth)

6080
RADIOFREQUENCY IONIZATION CHAMBER. Fernando Alba Andrade, Eduardo Diaz Losada, Alonso Fernández, and Indalecio Gómez (Instituto de Física de la Universidad Nacional de México). Rev. mex. fís. 3, 107-14(1954). (In Spanish)

A radiofrequency ionization chamber was designed and constructed in the laboratory of physics and is working satisfactorily. The mechanical and electrical description of this apparatus is given. (tr-auth)

6081
THE QUANTITATIVE STUDY OF LATENT IMAGE FORMATION BY IONIZING PARTICLES. A. L. Kartuzhanskii (Leningrad Agricultural Inst.). Soviet Phys. (Doklady) 2, 287-90(1957) May-June.

The formula for the density of an ionizing particle track in a photographic emulsion is used to provide a new approach to a quantitative study of latent image formation by ionizing particles passing through photographic emulsion crystals. The formulas for the minimum path that provides a photographically effective passage of a given particle through a crystal of the emulsion and the minimum number of conduction electrons required to permit development of the emulsion crystals are derived. Two examples of the application of this method to an analysis of particle tracks are given. (J.S.R.)

6082
MEASUREMENT OF THE TRANSIENT DISCHARGE RADIATION IN GEIGER-MUELLER TUBES AND THEIR APPLICATION TO THE DESCRIPTION OF A RADIATION FIELD. Paul Kienle (Laboratorium für Technische Physik der Technischen Hochschule, Munich). Z. Naturforsch. 13a, 37-47(1958) Jan. (In German)

The radiation time of the discharge in the Geiger-Mueller tube was measured, inclusive of its total fluctuation, according to two methods, from a single irradiated spot up to one complete end of the tube. With one of the two methods additional fluctuations of the radiation time could be observed at small time intervals. The measurements contributed to the explanation of the disputed radiation mechanism in the Geiger-Mueller tube. It was shown that the statistical fluctuations of the radiation velocity of the discharge is quite small. The time between the start of the discharge at the single irradiated spot and its arrival at the end of the tube is therefore a good measurement for the radiation gradient in a tube. In this manner a localization of the single beam spot to 5 mm in a range of 50 cm was obtained with specific tube types. By application of these new methods an arrangement was obtained with which the expanded radiation fields on an oscillograph screen could be formed and photographed. The intensity distribution was determined photometrically from the images. The method can bring an advance to the measurement of radiochromatographs and in medical applications. (tr-auth)

Mesons

6083 UCRL-8054
California. Univ., Berkeley. Radiation Lab.
PHYSICS DIVISION QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, OCTOBER 1957. 36p. Contract W-7405-eng-48. $1.00(OTS).

Data obtained from the exposure of 1.1-Bev/c pions to the 10-in. liquid H bubble chamber are given for the following processes: $\pi^- + p \rightarrow K^0 + \Lambda$, $\pi^- + p \rightarrow \Sigma^- + K^+$, $\pi^- + p \rightarrow \Sigma^0 + K^0$, and strange-particle interactions in flight. Some data are presented from the analysis of Σ-hyperon decay for asymmetry. The upper limit on the asymmetry parameter in Λ^0 decay imposed by charge-conjugation invariance was calculated as 0.18 ± 0.02. An attempt to observe the reaction $p + p \rightarrow \bar{n} + He^3$ is described. (For preceding period see UCRL-3914.) (M.H.R.)

6084

THE INTERACTIONS OF K^- MESONS AT REST WITH TWO NUCLEONS. André Berthelot, Odette Goussu, Francoise Lévy, and Livio Scarsi. Compt. rend. 244, 447-50(1957) Jan. 21. (In French)

6085

MULTIPLE PRODUCTION OF HEAVY PARTICLES IN TWO NUCLEON COLLISIONS. V. S. Barashenkov, B. M. Barbashev, and E. G. Bubelov (Joint Inst. of Nuclear Research, Dubna, USSR) and V. M. Maksimenko (P. N. Lebedev Physical Inst., USSR Academy of Sciences, Moscow). Nuclear Phys. 5, 17-22(1958) Jan.

The probabilities of particle production in nucleon-nucleon collisions at an energy of E = 5 Bev have been calculated using Fermi's statistical theory and by taking into account the conservation of baryon number, strangeness, isobaric spin as well as strong resonance pion-nucleon interaction in the T = 3/2, P = 3/2 state. Various effective space volumes in which secondary particles are produced are considered. (auth)

6086

INVESTIGATION OF ASYMMETRY OF $\pi^+ \rightarrow \mu^+ \rightarrow e^+$ DECAYS IN PHOTOGRAPHIC EMULSIONS. A. O. Weissenberg and V. A. Smirnitsky (USSR Academy of Sciences, Moscow). Nuclear Phys. 5, 33-40(1958) Jan.

The energy dependence of the angular distribution of positrons relative to the direction of emission of μ^+ mesons produced in $\pi^+ \rightarrow \mu^+ \rightarrow e^+$ decays is studied in photographic emulsions. (auth)

6087

POSSIBLE EXPERIMENTS ON THE BEHAVIOUR OF THE WEAK HYPERON DECAY INTERACTIONS UNDER P, C, AND T. R. Gatto (Univ. of California, Berkeley). Nuclear Phys. 5, 183-6(1958) Jan.

Various experimental possibilities for detecting the transformation properties of the weak hyperon decay interactions under P, C, and T are discussed. (auth)

6088

PARITY NONCONSERVATION AND DECAY OF HYPERON. Shigeo Minami and Yoshio Yamaguchi (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 18, 39-50(1957) July.

Under the assumption that the parity conservation does not hold for the decay processes of strange particles, both the angular distribution of the final decay product for the cascade decay of Ξ hyperon and the asymmetrical distribution of decay product about the production plane of hyperons which are produced by $K^- - p$ interaction are examined. So far as the kinematical study for these processes is concerned, it is impossible to know whether the decay interaction is invariant under the time reversal. However, there exists a possibility of solving this problem by making use of the values of phase shifts for $\pi - N$ scattering. Namely, if the two decay interactions, $\Xi \rightarrow \Lambda + \pi$ and $\Lambda \rightarrow N + \pi$, are invariant under the time reversal, it may be expected that the fore-aft asymmetry (with respect to the direction of motion of Λ) of the final decay product for the cascade decay will be observed, while if they are simultaneously invariant under the charge conjugation, the existence of asymmetrical angular distribution can not be confirmed. (auth)

6089

PHOTOPRODUCTION OF MESONS ON NUCLEONS: PHASE SHIFT ANALYSIS AND DISPERSION RELATIONS. L. D. Solovyov (Moscow State Univ.). Nuclear Phys. 5, 256-70(1958) Jan.

A phase shift analysis of the dispersion relations for photoproduction of mesons is carried out. It is assumed that the integrals in the dispersion relations converge with sufficient rapidity. The dependence of the photoproduction amplitude on the spin and isobaric variables and also the relation between the photoproduction and scattering amplitudes which follows from the unitary condition are considered. The range of unobservable angles, $\cos\theta < -1$, in the dispersion relations is examined in the c.m.s. Phase shift analysis of the photoproduction amplitude is investigated and dispersion relations for partial waves have been obtained on the assumption of rapid convergence of the integrals. In this case the equations for S and P waves have been completely determined in the first approximation differing from the static one (that is, to terms of the order of μ/m). (auth)

6090

SOME REMARKS ON K-MESON DECAYS. S. Oneda (Univ. of Manchester) and S. Kamefuchi (Univ. of Copenhagen). Nuclear Phys. 5, 301-18(1958) Jan. (2).

The standpoint that the $K \rightarrow \mu(e) + \nu$ and the $K^0 \rightarrow \pi + \pi$ interactions are the primary weak interactions responsible for all K-meson decays is investigated in detail. The significance of this standpoint is discussed in connection with the true elementarity of the so called elementary particles. It is shown that this model necessarily requires the existence of two spin zero K mesons which are degenerate in parity. The direct experimental tests of the primarity of $K \rightarrow \mu(e) + \nu$ interactions in the $K_{\mu 3}$ and K_{e3} decays are mentioned. The evaluation of the branching ratios of K meson decays in this model and the estimate of the magnitude of the strength of the KKπ-interaction are made. The comparison with the standpoint that the weak Fermi interaction is primary is discussed and it is inferred that the latter is more promising. (auth)

6091

ON THE POLARIZATION OF μ-MESONS IN $K_{\mu 3}$ DECAYS. L. Okun (USSR Academy of Sciences, Moscow). Nuclear Phys. 5, 455-63(1958) Feb.

A calculation of the longitudinal polarization of μ mesons in $K_{\mu 3}$ decays (and of electrons in K_{e3} decays) is carried out under the assumption that the neutrino emitted in these processes is longitudinally polarized. (auth)

6092

DISPERSION RELATIONS FOR HEAVY MESON-NUCLEON INTERACTION IN A FIXED SOURCE THEORY. II. EFFECTIVE RANGE RELATIONS. D. Amati (Istituto di Fisica Teorica dell'Università, Naples and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 6, 1273-81(1957) Dec.

The dispersion relations for heavy meson-nucleon interaction in fixed source theory, derived in a previous paper, are used in order to obtain effective range type relations. Both scalar and pseudoscalar K mesons are considered. In the first section the desired inversion of the scattering amplitudes satisfying dispersion relations is carried out. In the third one the obtained effective range relations are discussed, together with the possibility of obtaining approximate solutions for the scattering amplitudes starting directly from the dispersion relations. (auth)

6093

ANALYSIS OF PROCESSES INVOLVING BARYONS, PIONS AND HEAVY MESONS. D. Amati (Istituto di Fisica Teorica dell'Università, Naples, and Istituto Nazionale di Fisica Nucleare, Rome) and B. Vitale (Istituto di Fisica dell'Università, and Centro Siciliano di Fisica Nucleare, Catania, Sicily). Nuovo cimento (10) 6, 1282-91(1957) Dec.

The role played by the fields present in any strong interaction is analyzed by means of dispersion relation techniques. This helps to clarify the effects of virtual states in physical processes where only a few of the

many interacting fields are present in the initial and final states as real particles, and the way the renormalized coupling constants appear in the integral relations for the amplitudes corresponding to scattering, production, and absorption processes. (auth)

6094

K-MESON PHOTOPRODUCTION IN A MANY FIELD INTERACTION. D. Amati (Istituto di Fisica Teorica dell'Università, Naples and Istituto Nazionale di Fisica Nucleare, Rome) and B. Vitale (Istituto di Fisica dell'Università and Istituto Siciliano di Fisica Nucleare, Catania, Sicily). Nuovo cimento (10) 6, 1318-23(1957) Dec.

K-meson photoproduction is analyzed by means of dispersion relation techniques in order to clarify the role played by pion and $\overline{K}$ virtual states, the crossing relation between K photoproduction on nucleons and radiative absorption of $\overline{K}$ by nucleons, and the way charge and magnetic moments appear in the relation satisfied by the amplitude corresponding to the photoproduction process. (auth)

6095

REMARKS ON THE POSSIBLE EXISTENCE OF A NEUTRAL MUON. R. E. Marshak and E. C. G. Sudarshan (Univ. of Rochester, N. Y.). Nuovo cimento (10) 6, 1335-8 (1957) Dec.

The arguments for and against the existence of a neutral muon are discussed. The weak interactions in which a neutral muon might replace the neutrino are enumerated. It is concluded that the most favorable experimental circumstances, for the detection of the neutral muon would obtain if one searches for the reaction $K^+ \rightarrow \mu^+ + \mu^0$. (auth)

6096

SEARCH FOR THE ELECTRONIC DECAY OF THE POSITIVE PION. H. L. Anderson (Scuola di Perfezionamento in Fisica Nucleare dell' Università, Rome) and C. M. G. Lattes (Univ. of Chicago). Nuovo cimento (10) 6, 1356-81 (1957) Dec.

A double-focusing magnetic spectrometer of high transmission and good resolution was used in search for the electronic decay of the positive pion. No evidence was found. (A.C.)

6097

THE STUDY OF POLARIZATIONS OF SECONDARY MUONS IN K-MESON DECAY PROCESSES. S. Furuichi, S. Sawada, and M. Yonezawa (Hiroshima Univ.). Nuovo cimento (10) 6, 1416-29(1957) Dec.

To get the knowledge of weak interactions acting in the K-meson decay processes having the muons in their decay products, the authors have investigated the polarization of the emitted muons in these processes, taking the viewpoint that the weak Fermi interaction is participating for the decay processes and the neutrino associated is of two components. For the determination of the type of weak interaction in $K_{\mu 3}$ meson it is useful to analyze the longitudinal polarization of muons. Although the main interest is in the type determination of weak interactions, the spin of the K meson is also examined, and the analysis shows that the polarization of muons is in general not complete for spin 1 $K_{\mu 2}$ mesons in contrast with spin 0 $K_{\mu 2}$ mesons. (auth)

6098

ENERGY SPECTRUM OF PIONS AND POLARIZATION OF MUONS AND ELECTRONS IN THE $K_{\mu 3}$ AND K_{e3} DECAY. S. W. McDowell (Univ. of Birmingham, Eng.). Nuovo cimento (10) 6, 1445-60(1957) Dec.

In this paper two aspects of the $K_{\mu 3}$ and K_{e3} decay are discussed: the energy density of final states and the longitudinal polarization of the muons and electrons. It is assumed that the fermion pair is produced through a Fermi interaction which can be of scalar, vector or tensor type. The two-component theory of the neutrino is used. The energy spectra and polarization depend in general on three complex parameters. However, if the theory is to be invariant under time reversal, the parameters must be real. With the values of the parameters determined from the energy spectrum one can predict the polarization. This provides a good check of the two-component theory. (auth)

6099

EFFECTIVE CROSS SECTION FOR THE DIRECT GENERATION OF ELECTRON PAIRS BY μ MESONS. RELATION WITH MAGNETIC MOMENTS. M. Avan and L. Avan (Laboratoire de Physique Corpusculaire, Université, Caën, France). Nuovo cimento (10) 6, 1500-1(1957) Dec. (In French)

6100

MOMENTUM SPECTRUM OF POSITRONS FROM THE DECAY OF μ^+ MESONS. Lawrence Rosenson (Univ. of Chicago, Ill.). Phys. Rev. 109, 958-72(1958) Feb. 1.

The momentum spectrum of positrons from μ^+ decay has been examined. The detecting instrument was a 20-atmos hydrogen-filled diffusion cloud chamber, operated in a magnetic field of 7000 gauss. The data have been compared with the spin-$\frac{1}{2}$ μ-meson theory of Michel, as modified by Behrends, Finkelstein, and Sirlin, to include first radiative corrections, and with the spin $\frac{3}{2}$ theory of Behrends and Fronsdal. Statistical analysis of the 1300 acceptable events yields the shape parameters $\rho_R = 0.65 \pm 0.05$ (standard deviation) and $\rho_{\frac{3}{4}} = 0.26 \pm 0.04$ (standard deviation). The theoretical spectra described by shape parameters in the vicinity of the best fits are very similar and this experiment cannot discriminate between the two spin assignments for the μ meson. The value of ρ_R can be related to the Michel parameter ρ_M, and gives $\rho_M = 0.67 \pm 0.05$ (standard deviation). The result for ρ_{Michel} was related to published β-decay data, and restrictions on a common interaction for β and μ decay were deduced. (auth)

6101

MAGNETIC MOMENT OF THE FREE MUON. T. Coffin, R. L. Garwin, S. Penman, L. M. Lederman, and A. M. Sachs (Columbia Univ., New York). Phys. Rev. 109, 973-9(1958) Feb. 1.

The magnetic moment of the positive μ meson has been measured in several target materials by a magnetic resonance technique. Muons were brought to rest with their spins parallel to a magnetic field. A radiofrequency pulse was applied to effect a spin reorientation which was detected by counting the decay electrons emerging after the pulse in a fixed direction. Results are expressed in terms of a g factor which for a spin $\frac{1}{2}$ particle is the ratio of the actual moment to $e\hbar/2m_pc$. The most accurate result obtained in a $CHBr_3$ target, is that $g = 2(1.0026 \pm 0.0009)$ compared to the theoretical prediction of $g = 2(1.0012)$. Less accurate measurements yielded $g = 2.005 \pm 0.005$ in a copper target and $g = 2.00 \pm 0.01$ in a lead target. (auth)

6102

$K_{\mu 3}$ DECAY: TESTS FOR TIME REVERSAL AND THE TWO-COMPONENT THEORY. J. J. Sakurai (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 109, 980-3(1958) Feb. 1.

The $K_{\mu 3}$ decay is investigated with special attention to possible muon polarization normal to the decay plane $[\sigma_\mu \cdot (p_\pi \times p_\mu)]$ which can be detected by observing an "up-down" asymmetry in the electron distribution in the subsequent parity-nonconserving muon decay. If the K particle is spinless or is unpolarized, the presence of such polari-

zation would indicate that invariance under time reversal is violated in the $K_{\mu 3}$ decay. This polarization is calculated field-theoretically for the spinless K particle. In addition, a sensitive test for the two-component theory of the neutrino is proposed for the decay configuration in which the three decay products are collinear. (auth)

6103

DECAY OF THE Σ^+ HYPERON AND ITS ANTIPARTICLE. Susumu Okubo (Univ. of Rochester, N. Y.). Phys. Rev. 109, 984-5(1958) Feb. 1.

Two decay modes of the Σ^+ hyperon and the corresponding ones for its antiparticle are investigated. The branching ratio may be different for both, if charge-conjugation invariance or time-reversal invariance does not hold. (auth)

6104

INTERNAL PAIR CREATION IN Σ^0 DECAY. G. Feinberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1019-20(1958) Feb. 1.

6105

PARITY NONCONSERVATION IN NEUTRINO INTERACTIONS AND THE $\tau-\theta$ PROBLEM. R. Gatto (Univ. of California, Berkeley). Nuclear Phys. 5, 235-55(1958) Jan.

Solutions of the $\tau-\theta$ problem are sought whereby one could avoid the conclusion that parity is violated also in weak interactions not involving neutrinos. It is shown that no such solutions can be constructed that are theoretically acceptable, and experimental tests are indicated for a definite disproof of such models. The discussion is limited to the usual description of neutrino interactions such that the known neutrino processes occur at first order in the neutrino coupling constants. (auth)

6106

CHARGE DISTRIBUTION OF PIONS PRODUCED IN HIGH ENERGY NUCLEAR COLLISIONS. Yoshihiro Yamamoto (Metropolitan Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 18, 81-6(1957) July.

The charge distribution of pions produced in a high energy collision of two nucleons is calculated by means of a statistical model including excited nucleons. The results are compared with experimental data. The qualitative agreement is obtained for the ratio of (single π^-) to ($\pi^- + \pi^0$) to ($\pi^+ + \pi^-$) in an n-p collision, but not for the ratio of (π^+) to (π^-) in a p-Be collision. (auth)

6107

ON THE EFFECTIVE COUPLING STRENGTH IN THE STATIC PION THEORY. Tetsuro Kobayashi, Jun'ichi Osada, and Smio Tani (Tokyo Univ. of Education). Progr. Theoret. Phys. (Kyoto) 18, 89-91(1957) July.

6108

SOME REMARKS ON THE GOLDHABER MODEL FOR STRANGE PARTICLES. Rokuo Kawabe (Nagoya Univ.). Progr. Theoret. Phys. (Kyoto) 18, 96-7(1957) July.

6109

THE INNER BREMSSTRAHLUNG OF A POLARIZED μ-MESON AND THE NONCONSERVATION OF PARITY. I. G. Ivanter (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 1383-6(1957) Dec. (In Russian)

Under the assumption of the combined parity conservation, the formulas are derived for the angular and energy distributions of the inner bremsstrahlung accompanying the disintegration of a polarized μ meson. (tr-auth)

6110

ONE OF THE POSSIBILITIES FOR CLASSIFICATION OF BARYONS. Kh. Yiglane (Inst. of Physics and Astronomy, Academy of Sciences, Estonian S.S.R.) Zhur. Eksptl'. i Teoret. Fiz. 33, 1537-8(1957) Dec. (In Russian)

Meteorology

6111

FIRST REPORT ON STUDIES OF RADIOACTIVE RAIN. Fernando Alba A., Virgilio Beltrán, T. A. Brody, Hugo Lezama, A. Moreno M., A. Tejera, and M. Vásquez B. (Instituto de Física de la Universidad Nacional Autónoma de México). Rev. mex. fís. 5, 153-66(1956). (In Spanish)

Data of radioactive rainfall are presented, obtained by the method of the gummed paper and that of collection on a free surface of water. The experimental methods are described. Some conclusions about the relative efficiency of the methods and their relation to the atmospheric precipitation were obtained. (tr-auth)

Neutrons

6112 AECU-3628

Wisconsin. Univ., Madison.

POLARIZATION OF NEUTRONS SCATTERED BY INTERMEDIATE AND HEAVY NUCLEI. J. D. Clement, F. Boreli, S. E. Darden, W. Haeberli, and H. R. Striebel. [1957]. 19p. Contract [AT-11-1-GEN-7]. $3.30(ph OTS); $2.40(mf OTS).

Measurements of the polarization produced in the scattering of neutrons from heavy nuclei have been carried out at neutron energies of 380 and 980 kev. The $Li^7(p,n)Be^7$ reaction was used as a source of polarized neutrons. Right-left asymmetries in scattering of these neutrons from several elements ranging in atomic weight from 55 to 238 were measured at scattering angles of 55, 90, and 130°. With few exceptions the observed polarizations vary smoothly with atomic weight. Measured values of the polarization range from −0.11 to +0.15 at 380 kev, and from −0.17 to +0.20 at 980 kev. The results at 380-kev neutron energy are compared with values predicted by the complex square well potential modified by a surface spin-orbit interaction. Using several sets of well parameters it has not been possible to reproduce the experimental results. (auth)

6113 AERE-R/R-2403

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DIFFUSION LENGTH OF THERMAL NEUTRONS IN PORTLAND CONCRETE. R. A. Dugdale and E. Healy. Oct. 1957. 8p. (SWP/P-42). $0.32(BSD).

A measurement of the diffusion length of thermal neutrons in Portland concrete, originally made by Salmon two years previously, has been repeated. An apparent decrease from 7.04 cm to 6.61 cm has occurred. This change, which is only four times the standard deviation of the result, could be due to a small increase in water content. In assessing the amount required, a discrepancy between calculated and measured diffusion length was found. Possible explanations of the discrepancy are discussed. (auth)

6114

AN ION SOURCE WITH ELECTRON BOMBARDMENT. Daniel Blanc and André Degeilh. Compt. rend. 246, 936-9 (1958) Feb. 10. (In French)

The characteristics of an ion source of the Nier type used without an auxiliary magnetic field are described. Its operation under variable pressures and acceleration voltages was studied. The ion flow exceeds 50 μa for voltages higher than 8 kv (for air). (tr-auth)

6115

MEASUREMENTS OF THE ABSOLUTE STRENGTHS OF NEUTRON SOURCES. V. M. Bezotosnii and Yu. S. Zamyatnin. J. Nuclear Energy 6, 237-42(1958).

A short account is given of methods of calibrating neutron sources used in various laboratories of the U.S.S.R. Academy of Sciences. A method used by the authors for measuring the absolute intensity of a source is described in detail. This method was developed by the authors during 1950-1951 and is based on a principle suggested by O'Neal and Scharff-Goldhaber. Values for the measured intensity of a standard radium-beryllium source, N-23, obtained in various laboratories of the Academy of Sciences are compared. This standard source consisted of a mixture of equal parts of a radium salt with beryllium powder in a container. (auth)

6116

THE STANDARDIZATION OF NEUTRON SOURCES USING THE GRAPHITE STACK OF A REACTOR. B. G. Erozolimsky and P. E. Spivak. J. Nuclear Energy 6, 243-50(1958).

A method of standardizing a neutron source is put forward which involves the comparison, within a graphite stack, of the effect of the source with that of a sink created by introducing an absorber. The apparatus is described, and an account is given of experiments by which the authors, in 1951, calibrated Ra-α-Be and Ra-γ-Be sources to an accuracy of $\pm 3\%$. (auth)

6117

THIN REGIONS IN DIFFUSION THEORY CALCULATIONS. Eugene L. Wachspress (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 3, 186-200 (1958) Feb.

A method for determining effective cross sections for geometrically thin absorbing regions in multigroup calculations is described. The effective absorption cross section in multigroup calculations provides a smooth transition from the usual diffusion theory cross section for low absorption slabs to the $\frac{2}{3}\lambda_{tr}$ extrapolated end-point condition for black slabs. In effect, the average flux between mesh points of the difference equation grid is related to the fluxes at the mesh points. Self-shielding effects are accounted for by material cross section rather than difference equation modification. Application of the theory to lattice calculations is discussed, and comparisons are made with other methods for limiting cases. (auth)

6118

WAVE EQUATION FOR A FREE NUCLEON. Kh. Yiglane (Inst. of Physics and Astronomy, Estonian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1511-12(1957) Dec. (In Russian)

6119

SPATIAL ENERGY DISTRIBUTION OF NEUTRONS IN HEAVY GASEOUS ATTENUATOR. M. V. Kazarnovskiĭ (Lebedev Inst. of Physics). Zhur. Eksptl'. i Teoret. Fiz. 33, 1533-5(1957) Dec. (In Russian)

Nuclear Physics

Refer also to abstracts 5974, 6374, 6379, 6380, 6381, 6382, 6384, 6385, and 6386.

6120 AECU-3633

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PROGRESS REPORT NO. 50 [FOR] THE PERIOD JUNE 1, 1957 THROUGH AUGUST 31, 1957. Aug. 31, 1957. 64p. Contracts AT(30-1)-905 and Nonr-1841(16). $10.80(ph OTS); $3.90(mf OTS).

Progress is reported in fission elements chemistry, organic and inorganic nuclear chemistry, cosmic ray research, high-energy accelerator experimentation and physics, bubble chamber experimentation, and theoretical physics. Considerable attention was given to the ionization of mineral acids and hydrogen halometallates in inorganic solvents and to anion exchange behavior in metal complexes. Studies of various chemical reaction mechanisms were continued. The self-energy of a Dirac particle coupled through its charge with the electromagnetic field was investigated without perturbation theory. (For preceding period see AECU-3580.) (D.E.B.)

6121 CU-169

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. Pegram Lab.

PROGRESS REPORT FOR JULY, AUGUST, SEPTEMBER 1957 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 50p. Contract AT-30-1-GEN-72. $7.80(ph OTS); $3.30(mf OTS).

The Nevis neutron velocity spectrometer was successfully operated with the 2000 channel analyzer. Measurements were taken using 0.2μsec detector gates on Cd, Ta, and NaBr. A scintillation neutron detector using the $B^{10}(n,\alpha)Li^7$ reaction was used successfully with the velocity selector. Efficiencies for this detector were better than for a ZnS-B mixture. Results from studies of mass distribution of fission fragments from U^{233} and U^{235} indicate the distribution may be different for different spin levels. Total neutron cross sections were measured for several elements in the energy range 4 to 8 Mev. The Columbia neutron spectrometer was used to study neutron transmission in borosilicate glass, pure Y, liquid Bi, and eight metallic hydrides. A proton beam was accelerated by the cyclotron to the deflection radius of 15 in. Radial distribution measurements of the beam showed a drop from 700 to 20 μa between 10 and 15 in. The decay scheme of Pm^{150} was reinvestigated. A new polishing technique for CsI crystals was used to improve the resolution of charged particle groups to 3 or 4% for 5 Mev protons. The polarization of β particles from Y^{90} and Au^{198} was investigated by using electron–electron scattering. For both isotopes the polarization was $-v/c$. The positron spectrum of 0.9 sec Ca^{39} was measured with a magnetic thin lens spectrometer. (For preceding period see CU-161.) (D.E.B.)

6122 NP-6569

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period October–December 1957. Jan. 1, 1958. 28p.

A device called the epitron has been proposed for accumulating a very high electron current in a magnetic field. A third-order nonlinear total differential equation arising in the problem of the injection orbits of this device is developed and discussed. In order to compare the yields of photo-alpha particles from various elements, thin foils were irradiated with 21.5 Mev bremsstrahlung hardened by graphite. Alpha emissions were detected in nuclear emulsions. The experimental arrangement is shown, and the alpha yields for a number of elements are tabulated. A program was initiated to study the structure of various nuclei by resonance fluorescence. The technique and nuclear parameters measured are discussed. Preliminary integrations of the differential equations of motion governing the initial collapse of a relativistic electron beam injected into hydrogen are presented. Additional results are given from studies of the effects of alkali and phosphate additions on the corrosion of low-carbon steel by water. (D.E.B.)

6123

ON THE LONG-RANGE CORRELATION MODEL OF THE PHOTONUCLEAR EFFECT. M. Danos (National Bureau of Standards, Washington). Nuclear Phys. 5, 23-32(1958) Jan.

The long-range correlation model, i.e., the hydrodynamic "second-sound" model, of the photonuclear effect predicts a splitting of the giant resonance in deformed nuclei. As a result of this, the width and the shape of the observed resonance will be different in different nuclei. The hydrodynamic model further predicts the existence of a second-sound monopole mode at roughly twice the energy of the dipole mode. However, the resonance energy is so high that this mode may be damped completely except, perhaps, in the heaviest nuclei. Observation of this mode could yield information about the energy dependence of the friction coefficient Γ of second-sound in nuclear matter. (auth)

6124

A SEMI-EMPIRICAL FORMULA FOR THE NUCLEAR RADIUS. L. R. B. Elton (King's Coll., London). Nuclear Phys. 5, 173-8(1958) Jan.

It is shown that the experimental results on negaton and proton scattering by nuclei are in agreement with the assumptions that the central density of nuclear matter is constant for all nuclides and that the neutron and proton distributions in a nucleus are the same. (auth)

6125

WIDTHS OF THE GIANT RESONANCE OF PHOTONUCLEAR REACTION. M. Soga (Tokyo Univ. of Education) and J. Fujita (Nihon Univ., Tokyo). Nuovo cimento (10) 6, 1494-9(1957) Dec.

The aim of this note is to point out that the Okamoto-Danos effect is not inherent in the dipole vibration model in regard to the mechanism of photon absorption, but it also exists in the case of single-particle absorption in a deformed nucleus. A detailed study along this line will be able to give a clue to solve the interesting problem of studying the mechanism of photon absorption. (A.C.)

6126

INNER SHELL STRUCTURE OF NUCLEI. H. Tyrén, Th. A. J. Maris, and P. Hillman (Univ. of Uppsala). Nuovo cimento (10) 6, 1507-9(1957) Dec.

States in which the inner shells are intact are comparable with atomic states leading to optical transitions. The nuclear states corresponding to x-ray states in atoms have holes in inner shells. The purpose of this note is to report preliminary results of a method of investigating such states. (A.C.)

6127

VELOCITY-DEPENDENT FORCES AND NUCLEAR STRUCTURE. II. SPIN-DEPENDENT FORCES. Marcos Moshinsky (Instituto de Fisica, Universidad de Mexico e Instituto Nacional de la Investigacion Cientifica, Mexico, D. F.). Phys. Rev. 109, 933-41(1958) Feb. 1.

Recent investigations have shown the presence of velocity-dependent forces in the two-nucleon interaction, increasing the number of parameters in the two-nucleon potential, and making more difficult the determination of these parameters in a unique way. In view of the successes of the shell model and of the assumptions that the same interactions hold between nucleons inside nuclear matter as between free nucleons, it is of interest to explore the possible restrictions on the two-nucleon potential that follow from level arrangements and separations in nuclear shell theory. In the present paper this exploration is carried out for velocity-dependent forces, starting with the two-body spin-orbit force, two forms of which have recently been proposed, and considering also the simplest velocity-dependent forces that depend on the second power of the momentum, which include the velocity-dependent tensor force recently introduced by Breit. The two-body spin-orbit force of Gammel and Thaler has a very short range, and, taking advantage of this fact, it is shown that the interaction energy for two nucleons in the same shell is proportional to the interaction energy for the zero-range velocity-dependent central force discussed previously by the author. The simple expression for the interaction energy allows the comparison of the level separation due to the spin-orbit force of Gammel and Thaler and that due to the spin-orbit force of Signell and Marshak. Also the effects of both types of spin-orbit forces with the interaction energy due to the central even singlet force of Gammel, Christian, and Thaler are compared. A velocity-dependent central force that acts only in the triplet state is analyzed. The velocity-dependent tensor potential in the long-range approximation is discussed, and it is shown that the restrictions that follow on the strength of this potential from the assumption that the separation between levels should be small compared with the separation between shells. The velocity-dependent tensor potential in the short-range approximation is discussed, and restrictions on the product of strength and range of this potential are obtained. The interaction energies for all short-range velocity-dependent potentials show similarities, suggesting the possibility of finding simple closed expressions for the interaction energies for all short-range forces. (auth)

6128

NUCLEONIC BINDING STATES IN NONSPHERICAL NUCLEI: ASYMPTOTIC REPRESENTATION. A. J. Rassey (Univ. of California, Los Angeles). Phys. Rev. 109, 949-57(1958) Feb. 1.

An alternative description is given for Nilsson's analysis of nucleonic motion in a strongly deformed nuclear field. The aim is to obtain the single-particle states for the region of strong deformation in terms of a representation which is especially suited for that region in contrast to the spherical representation used by Nilsson. The eigenvectors of a 3-dimensional anisotropic harmonic oscillator (H.O.) are used as a basic set to calculate the single-particle wave functions and energy eigenvalues. Two immediate advantages of choosing this basic set are: first, the matrix elements between single-particle states are expressible in terms of the rather simple analytic expressions obtained for these matrix elements in the H.O. representation and second, the expansion of the particle wave functions generally is rather pure, so that in many instances the leading term in the expansion is sufficient for calculations. Thus, good approximate calculations are easily obtainable. The high degree of purity of state has been taken advantage of previously by several authors to classify states in the strong-deformation region using the "almost good" quantum numbers of the basic set (asymptotic quantum numbers). Separate level spectra are given for protons and neutrons similar to the Mottleson and Nilsson scheme but more extensive (including some $N = 7$ shell neutron levels). A large gap at neutron number 152 offers a partial explanation of the closing of a subshell there previously interpreted by Ghiorso et al., from α-decay curves. New approximate transition selection rules are given for allowed and first-forbidden β decay. For allowed transitions the relative speed varies approximately as $10^{-|\Delta N_z|}$. For first forbidden transitions, relative speeds are tabulated as functions of ΔN_r. The latter transitions are generally cut down by a factor $(10^{-5}-10^{-6})$ for $|\Delta N_r| \geq 2$. (auth)

6129

E2 + M1 MIXED TRANSITIONS IN HEAVY ODD A NUCLEI. Mitsuhiro Kawamura (Saikyo Univ., Kyoto). Progr. Theoret. Phys. (Kyoto) 18, 87-9(1957) July.

Experimental data in the field of nuclear spectroscopy

show the existence of E2 + E1 mixed nuclear transitions. These mixing ratios are obtained from experiments on angular correlations, measurement of the angular distribution, the internal conversion coefficient, and the conversion ratio. In most cases the value of the mixing ratio obtained from one method does not always coincide with the value of that obtained from the other method for the same nucleus. However, since a certain appreciable variation between the mixing ratios for two nuclei differing in mass number is found, some information can be obtained on nuclear structure and the transition mechanism from data for the mixing ratio. (A.C.)

6130
STATIONARY FUSION REACTIONS AT LOW TEMPERATURES. Toshiyuki Nishiyama, Tamotsu Sekiya, and Yôiti Watanabe (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 18, 93-5(1957) July.

6131
MAGNETIC DIPOLE SUM RULES FOR PHOTODISINTEGRATION OF THE DEUTERON. Moti L. Rustgi and Joseph S. Levinger (Louisiana State Univ., Baton Rouge). Progr. Theoret. Phys. (Kyoto) 18, 100-1(1957) July.

6132
EMISSION OF PARTICLES FROM EXCITED NUCLEI. M. Z. Maximov. Zhur. Eksptl'. i Teoret. Fiz. 33, 1411-16 (1957) Dec. (In Russian)

A formula for the dependence of the cross section of a nuclear reaction involving emission of several particles on the energy of the incident nuclei is obtained on basis of results of the statistical theory of nuclei and Bohr's concept regarding nuclear reactions. The formula is used to compute the cross sections for nuclear reactions involving emission of 1, 2, 3, or 4 neutrons from Bi^{209} and I^{127} when the impinging particles are p, d, or α particles. The dependence of entropy of the nucleus on excitation energy and mass number was determined on basis of results of the gas nuclear model. The results of the calculations satisfactorily agree with the experimental data. (tr-auth)

6133
ELECTROMAGNETIC RADIATION IN HIGH ENERGY NUCLEAR INTERACTIONS. N. M. Gerasimova (Lebedev Inst. of Physics). Zhur. Eksptl'. i Teoret. Fiz. 33, 1457-60(1957) Dec. (In Russian)

Bremsstrahlung emitted by charged particles participating in high energy nuclear interactions is computed on basis of the hydrodynamical model of an elementary act. The fraction of radiated energy is found to be constant whereas bremsstrahlung from point charges is found to increase logarithmically with energy. (tr-auth)

6134
INFLUENCE OF FINITE NUCLEAR SIZE ON THE EFFECTS RELATED TO NONCONSERVATION OF PARITY IN BETA DECAY. B. V. Geshkenbein. Zhur. Eksptl'. i Teoret. Fiz. 33, 1535-6(1957) Dec. (In Russian)

Nuclear Properties

6135 AERE-R/R-2333
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
SOME PILE OSCILLATOR CROSS-SECTION MEASUREMENTS MADE IN THE DIMPLE THERMAL PIT. J. D. Cummins. Aug. 1957. 24p. $0.63(BSI).

The thermal neutron absorption cross-sections of La, Cs, Pr, Rh, H, Sm^{149} and Nd^{143} were measured by comparison with Harwell B. The ratio of the thermal neutron absorption cross-sections of Ag to Au was measured. A subcritical experiment for determining the weighting factor W, the fate of a fission neutron relative to a thermal neutron is described. Measurements of the thermal neutron absorption cross-sections of solutions of U^{233}, U^{233}, two Pu solutions of different isotopic content and for a piece of natural uranium for both global and local chamber arrangements are described. The measurement of the ratio of the weighting factor W^l, at a local chamber to the weighting factor W at a global chamber are described. An attempt to measure the weighting factor W by oscillating a source at various pile powers is described. Measurements of apparent absorption cross sections of solid samples of Al, C, Bi, Mo, Nb, Zr and Mg, of various physical shapes are also described. (auth)

6136 WAPD-185
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A COMPENDIUM OF THERMAL NEUTRON CROSS SECTIONS AVERAGED OVER THE SPECTRA OF WIGNER AND WILKINS. Harvey J. Amster. Jan. 1958. 157p. Contract AT-11-1-GEN-14. $4.25(OTS).

Values of 21 energy-dependent microscopic cross sections were estimated on the basis of the latest experimental data and averaged up to 0.625 ev over Wigner-Wilkins neutron spectra for 700 mixtures of U^{235}, Pu^{239}, a 1/v absorber, and a hydrogen moderator. (auth)

6137 WASH-194
[Nuclear Cross-Sections Advisory Group, AEC.]
REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, IDAHO FALLS, IDAHO, JULY 17-18, 1957. C. W. Zabel. 78p. $2.25(OTS).

An informal statement of recent developments, changes in emphasis, and preliminary data are included, the consideration of which is important to the cross section measurement program. The cross section measurement programs of the following laboratories are discussed: Argonne National Lab., Brookhaven National Lab., Columbia Univ., Duke Univ., Knolls Atomic Power Lab., Los Alamos Scientific Lab., Oak Ridge National Lab., Phillips Petroleum Co., The Rice Inst., and Univ. of California Radiation Lab. (M.H.R.)

6138
PERIOD OF THE FIRST ROTATIONAL LEVEL OF Ra^{226}. Hamlet Vartapetian and Roger Foucher. Compt. rend. 246, 939-42(1958) Feb. 10. (In French)

By the delayed α--γ coincidence method it was shown that the 67.6 kev level has a period $T_{1/2} = (6.3 \pm 0.7) \times 10^{-10}$ sec. From the measured angular correlations and the value of $T_{1/2}$ the electric field gradient existing in the region of the Ra nucleus was calculated. (tr-auth)

6139
MAGNETIC RESONANCE MEASUREMENT OF THE "COHERENCE TIME" OF Hg^{199} AND Hg^{201} ISOTOPES. Francoise Boutron, Jean-Pierre Barratt, and Jean Brossel. Compt. rend. 245, 2250-3(1957) Dec. 16. (In French)

A study of the 6^3P_1 level of isotope pairs of Mg by magnetic resonance methods leads to the determination of a "coherence time" which is much longer than the duration of the life of the level. At very low vapor densities, the "coherence time" approaches the level lifetime. Experimental results verified that the "coherence time" is dependent only on the number of diffusing atoms and on the observed hyperfine level and that it approaches the level lifetime. (J.S.R.)

6140
AVERAGE LIFE OF THE EXCITED STATE OF F^{17} AT 500 kev. Pierre Lehmann, Antoine Lévêque, Tovy Grjebine,

Jean-Loup Picou, and Roland Barloutaud. Compt. rend 245, 2259-61(1957) Dec. 16. (In French)

The period of the $\frac{1}{2}^+$ excited state of F^{17} at 500 kev is equal to $(2.9 \pm 0.9) \times 10^{-10}$ sec. This value is compatible with the existence of a weak coupling between the core and the exterior nucleon, identical to that which interprets the mirror transition of O^{17}. (tr-auth)

6141

MEASUREMENTS OF THE ENERGY DEPENDENCE OF THE FISSION NEUTRON YIELD PER NEUTRON ABSORBED IN ^{239}Pu AND ^{235}U IN THE RANGE 0.006-0.36 eV. H. M. Skarsgard and C. J. Kenward. (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy 6, 212-21(1958).

The energy dependence of η, the fission neutron yield per neutron absorbed, has been measured for Pu^{239} over the energy range 0.0070 to 0.36 ev and for U^{235} over the range 0.0060 to 0.050 ev, using a crystal spectrometer. For energies less than 0.050 ev a mechanical neutron-velocity selector was used in conjunction with the crystal spectrometer to eliminate higher order neutrons from the diffracted beam. For Pu^{239}, at 0.3 ev, η is found to be 78.5 per cent of its value at 0.0253 ev. A theoretical expression for η, based on single level parameters deduced from the published total cross section values, is fitted to the measured variation and gives a value for $\alpha_{(0.297)}$, the ratio of radiative capture to fission in the 0.297 ev resonance, of 0.80 ± 0.05. The temperature coefficient of the effective value of η averaged over a Maxwellian flux distribution is -0.027% per °C for temperatures in the vicinity of 20°C. Within experimental errors, η for U^{235} appears constant from 0.006 to 0.050 ev. (auth)

6142

AN ANALYSIS OF SLOW NEUTRON RESONANCES IN SILVER. E. R. Rae, E. R. Collins, B. B. Kinsey, J. E. Lynn, and E. R. Wiblin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 89-121(1958) Jan.

The spins, radiation widths, and neutron widths of ten levels in Ag^{109} and Ag^{110} have been determined from the measurement of total, elastic scattering, and radiative capture cross sections for slow neutron resonances with silver, in the range of neutron energy from 1 ev to 135 ev. The experimental measurements are described. The results of these measurements are combined by a least squares method of analysis to obtain an unambiguous assignment of level spin (J) and to derive values for the radiation and neutron widths. Seven levels are found to have $J = 1$ and three to have $J = 0$. The radiation widths appear to be approximately equal in both isotopes and to be independent of the level spins, $J = 0$ or 1. The theoretical implications of these results are briefly discussed. (auth)

6143

THE TWO-BODY SPIN-ORBIT INTERACTION. S. M. Vaidya (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 5, 179-82(1958) Jan.

The effect of the inclusion of a two-body spin-orbit interaction is considered for the deuteron. It is found that the change in the strengths of the central and the tensor interactions is significant and varies linearly with the strength of the spin orbit interaction. (auth)

6144

THE COULOMB EXCITATION OF U^{233} AND Np^{237} AND A DISCUSSION OF THE ENERGY LEVELS OF U^{233}. J. O. Newton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 218-34(1958) Jan.

Gamma rays of energy 40.4 ± 0.2, 51.5 ± 0.5, and 92.3 ± 1 kev for U^{233} and 33.24 ± 0.2 and 42.57 ± 0.3 kev for Np^{237} have been observed in the Coulomb excitation of these nuclei by helium ions; a xenon filled proportional counter was used as detector. The gamma rays are interpreted as arising from the decay of rotational states. From the absolute cross sections and from the branching ratios of the gamma rays from the second rotational states the reduced transition probabilities B_{E2} and intrinsic quadrupole moments Q_0 were estimated. Mean values for Q_0 of 13.7 and 9.0 barns were obtained for U^{233} and Np^{237}, respectively. Possible assignments of single particle states in a deformed potential to the ground state of Np^{237} and to the ground and excited states of U^{233} are discussed. (auth)

6145

PROTON POTENTIAL ANOMALY AND NUCLEAR RADIUS CONSTANT FOR MIRROR NUCLEI. P. C. Sood and A. E. S. Green (Florida State Univ., Tallahassee). Nuclear Phys. 5, 274-87(1958) Jan.

The static diffuse boundary potential well is adjusted to reproduce the binding energies of the last neutrons and protons in mirror nuclei. The corresponding realistic wave functions, including the effects of reduced mass, spin orbit interaction and Coulomb perturbation, are used to calculate the Coulomb energy differences for these nuclei. The exchange effect is taken into account by introducing an exchange correction factor based on a study with harmonic oscillator wave functions. The theoretical results are compared with the experimental values obtained from the atomic mass data and the agreement is found to be quite good. It is concluded that no appreciable proton potential anomaly exists in this region, i.e., the proton and neutron nuclear potentials are the same. The nuclear radii, as predicted by this model, are found to be in very good agreement with the results of Stanford electron-scattering experiments on five even-nuclei in this region. The calculations are carried out for the mirror nuclei, and a least square fit for the equivalent uniform radius R gives the value 1.31×10^{-13} cm for the nuclear radius constant $r_0 = RA^{-\frac{1}{3}}$ for these nuclei; this is compared with the results of earlier studies. The possible systematics of the variation of the radius constant with mass number are described and the significance of a larger radius constant for light nuclei is discussed. (auth)

6146

MEASUREMENTS ON ISOTOPE SEPARATED β-RAY SOURCES OF Re^{186} AND Re^{188}. K. O. Nielsen and O. B. Nielsen (Univ. of Copenhagen). Nuclear Phys. 5, 319-30 (1958) Jan. (2).

Isotopically pure β-ray sources of Re^{186} and Re^{188} were prepared from pile irradiated natural Re in an isotope separator. The spectrum of the β rays from Re^{188} to the ground state of Os^{188} was found not to have the allowed shape. The deviations are of the type earlier observed in the decay $Re^{186} \rightarrow Os^{186}$. Both transitions probably proceed from a 1^- to a 0^+ state. The K-conversion lines for the transitions from the 633 kev level in Os^{188} to the ground state and to the 155 kev 2^+ level were observed. The conversion coefficients indicate E2 nature for these transitions in agreement with an angular correlation experiment. The level schemes of Os^{186} and Os^{188} indicate that these nuclei lie in the transitional region between the strongly deformed nuclei and those of spherical equilibrium shape. (auth)

6147

THE ENERGY LEVELS OF Dy^{160}. S. Ofer (Hebrew Univ., Jerusalem). Nuclear Phys. 5, 331-45(1958) Jan. (2).

A study of the γ-ray transitions between levels of Dy^{160} resulting from the decay of Tb^{160} has been made using fast-slow coincidence technique. The angular correlations of six γ-ray cascades were measured. A decay scheme is suggested and assignments for the spins of excited levels and the multipolarities of the γ radiations are made. The results support the suggestion that the 970 kev and 1050 kev levels should be interpreted as collective vibrational levels. (auth)

6148

(n,α) AND (n,p) REACTIONS IN FLUORINE. E. Kondaiah, K. V. K. Iyengar, and C. Badrinathan (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 5, 346-50 (1958) Jan. (2).

The ratio of the (n,α) to (n,p) cross-section in F^{19} has been experimentally measured for 14.5 Mev neutrons as 1.2; this ratio has been calculated, on the basis of compound nucleus formation, to be 3.5. Comparing the calculated value with the experimentally observed value, it has been concluded that either the continuum assumption is not valid in this particular case or direct interactions are playing significant part specially in the (n,p) reaction. (auth)

6149

SCATTERING OF FAST NEUTRONS BY NEON-22. C. P. Sikkema, P. J. Pasma, and H. H. van Barneveld (Natuurkundig Laboratorium der Rijks Universiteit, Groningen, Netherlands). Nuclear Phys. 5, 351-7(1958) Jan. (2).

The scattering of monoenergetic neutrons by Ne^{22} has been studied in the neutron energy range 1.9 to 3.5 Mev, following a similar experiment carried out recently with natural neon. The total cross section of Ne^{22} shows 10 resonance maxima in this region, viz. at neutron energies of 2.01, 2.14, 2.19, 2.32, 2.53, 2.72, 2.87, 3.10, 3.20 and 3.43 Mev. Determination of resonance parameters with the help of energy distributions of recoil nuclei appeared to be difficult in most cases. The peak at 2.32 Mev is most probably due to a superposition of a $P_{\frac{1}{2}}$ and a $D_{\frac{3}{2}}$ resonance. (auth)

6150

A CONTRIBUTION TO THE ESTABLISHMENT OF THE LEVEL SCHEME OF RADIUM C'. G. R. Bishop (Laboratorie de Physique, Ecole Normale Supérieure, Paris). Nuclear Phys. 5, 358-82(1958) Jan. (2).

The gamma rays of radium C' (Po^{214}) and beta rays of radium C (Bi^{214}) have been studied by scintillator techniques. A decay scheme is proposed which is based on internal conversion coefficients, angular correlations between cascade gamma rays, and transition probabilities derived from the alpha-particle fine structure. There is some evidence that collective effects occur in this nucleus. (auth)

6151

LIFETIME OF THE FIRST ROTATIONAL STATE OF Gd^{158}. Ove Nathan (Univ. of Copenhagen). Nuclear Phys. 5, 401-4(1958) Jan. (2).

The half life of the 89-kev state of Gd^{158} has been measured by means of a fast-slow coincidence circuit. From the observed value $T_{\frac{1}{2}} = (1.9 \pm 0.1) \times 10^{-9}$ sec the reduced E2 transition probability can be calculated. One finds $B(E2; I_0 \rightarrow I_f) : e^2 = (5.1 \pm 0.3) \times 10^{-48}$ cm^4 in good agreement with the Coulomb excitation result of Ramšak et al. (auth)

6152

ON THE 2450-3400 kev REGION OF THE RaC GAMMA SPECTRUM. B. Dzhelepov, S. Shestopalova, and I. Uchevatkin (D. I. Mendeleev Research Inst. of Metrology, Leningrad). Nuclear Phys. 5, 413-15(1958) Feb.

Five new RaC (Bi^{214}) γ lines are reported of higher energy than those known heretofore. (auth)

6153

TWO-NUCLEON POTENTIAL FROM A MODEL OF PION-NUCLEON INTERACTION. F. Ferrari and L. Fonda (Istituto di Fisica dell'Università, Padua and Istituto di Fisica dell'Università, Trieste). Nuovo cimento (10) 6, 1510-12(1957) Dec.

The aim of this note is to show that a quantum-mechanical potential constructed from a model in which the interaction between pions and nucleons does not occur directly, but through an intermediate boson field, can account for the low-energy nucleon-nucleon phenomena, and that, in addition, the insertion of an intermediate field between pions and nucleons supports a possible explanation of the fact that the core radius is different in the triplet-even and the singlet-even state. (A.C.)

6154

ON THE STRUCTURE OF THE NUCLEON CORE. G. Domokos (Hungarian Academy of Sciences, Budapest). Nuovo cimento (10) 6, 1513-15(1957) Dec.

6155

RELAXATION EFFECTS FOR COUPLED NUCLEAR SPINS. Robert C. Rempel (Stanford Univ., Calif.). Phys. Rev. 109, 831-9(1958) Feb. 1.

Nuclear relaxation effects in molecules containing several coupled spins are treated by a generalization of the method of Wangsness and Bloch. Variations in line shape and structure for two coupled spin-½ nuclei as various parameters are changed from one extreme to another are derived and plotted graphically. The calculation is continued to obtain an expression for the line shapes in the double-resonance experiment of Bloom and Shoolery. It is next shown that under certain circumstances the concept of "semimacroscopic magnetic moments" enables one to write the quantum-mechanical equations of motion in the form of coupled Bloch phenomenological equations. In addition, a discussion of internal relaxation and the Overhauser effect is given. (auth)

6156

INVESTIGATION OF EXCITED STATES IN Be^8 BY ALPHA-PARTICLE SCATTERING FROM He. R. Nilson, W. K. Jentschke, G. R. Briggs, R. O. Kerman, and J. N. Snyder (Univ. of Illinois, Urbana). Phys. Rev. 109, 850-60(1958) Feb. 1.

Partial phase shifts have been deduced from the data on the scattering of α particles (12.3 to 22.9 Mev) from He, reported in an earlier publication. The interpretation of the phase shifts is as follows: The monotonic decrease of the S-wave phase shift throughout the energy range investigated indicates no broad S states in Be^8 for excitations between 0.5 and 11.45 Mev. The D-wave phase-shift energy dependence clearly indicates the 2.9-Mev 2^+ state in Be^8. The G-wave phase shift shows a broad 4^+ state in the neighborhood of 11 Mev with a reduced width of about 2 Mev. The I-wave phase shift is first observed at 20 Mev and is positive. Moderate success has been achieved in explaining the scattering results in terms of Haefner's alpha-particle model of Be^8. (auth)

6157

LIFETIME OF THE 0^+ EXCITED STATE IN Ge^{70}. Henry W. Kendall (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 109, 861-2(1958) Feb. 1.

It is found by a delayed-coincidence measurement that part of the 1.04-Mev gamma radiation following the beta decay of Ga^{70} is delayed with a mean life of $\tau = (4.0 \pm 0.9) \times 10^{-9}$ sec. This lifetime is assigned to the 0^+ level in Ge^{70} at 1.2 Mev which feeds the 2^+ level by a 0.174-Mev E2 transition. The observed mean life is about sixty times

shorter than the Weisskopf single-particle estimate for the quadrupole transition. (auth)

6158

NEUTRON TOTAL CROSS SECTIONS IN THE KEV REGION BY FAST TIME-OF-FLIGHT MEASUREMENTS. W. M. Good, J. H. Neiler, and J. H. Gibbons (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 926-33(1958) Feb. 1.

A new method employing millimicrosecond time measurement has been used to study neutron total cross sections in the 2- to 30-kev energy range. The method has been applied to the nuclides Na^{23}, Al^{27}, P^{31}, K^{39}, K^{41}, Rb^{85}, Rb^{87}, Sr^{86}, Sr^{88}, Y^{89}, Bi^{209}, and to natural Ti, Se, and Pb. A general result is that with the improved resolution of the new instrument, some new levels have appeared and a few previously reported were not observed. Of some special interest is the 2.8-kev resonance in Na^{23} which was definitely shown to have $J = 1$, $\sigma_0 = 380 \pm 10$ barns. It was observed that the strength function drops about a factor of ten when two protons are added to Rb^{87} to make Y^{89}. (auth)

6159

TOTAL NEUTRON CROSS SECTIONS NEAR 14 Mev. J. F. Vervier and A. Martegani (Centre de Physique Nucléaire del'Université de Louvain, Belgium). Phys. Rev. 109, 947-8(1958) Feb. 1.

The total cross section of U, Al, Mg, Cu, and C has been measured for neutron energies near 14 Mev by transmission experiments. The agreement with previous measurements is satisfactory; results are compared with theoretical predictions. (auth)

6160

EXCITED LEVELS OF CADMIUM 110. A. C. Knipper (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 71, 77-81(1958) Jan.

The γ rays in the decay of Ag^{110} have been observed using scintillation counters. A simplified decay scheme is presented. Spin assignments for the levels of Cd^{110} and mixing ratios of the γ rays are obtained from the comparison of angular correlations in the double and triple cascades. (auth)

6161

COULOMB EXCITATION OF SEPARATED ISOTOPES OF TIN. D. G. Alkhazov, D. S. Andreev, K. I. Erokhina, and I. Kh. Lemberg (Leningrad Inst. of Technical Physics). Zhur. Eksptl'. i Teoret. Fiz. 33, 1347-58(1957) Dec. (In Russian)

Alpha particles accelerated in a cyclotron to an energy of 14.5 Mev were used to investigate Coulomb excitation of nuclear levels in separated isotopes of tin. A number of previously unknown states were excited, for which the energy values and of the reduced probability of transition from the ground state were measured. The lifetimes of the first excited states of even-even isotopes of tin have been calculated. The lifetimes lie within the limits 5×10^{-13} sec(Sn^{114}) to 16×10^{-13} sec(Sn^{124}). (tr-auth)

6162

ON THE LOCALIZATION OF NUCLEONS IN O^{16} NUCLEUS. L. P. Rappoport and Yu. M. Butusov. (Voronezh State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1507(1957) Dec. (In Russian)

Attempts were made to localize nucleons in the O^{16} nucleus using J. Doudel's method. (J. Phys. Radium. 16, 503(1955).) (R.V.J.)

6163

QUADRUPOLE MOMENTS OF OSMIUM ISOTOPES AND LUTETIUM 175. E. E. Berlovich (Leningrad Inst. of Technical Physics). Zhur. Eksptl'. i Teoret. Fiz. 33, 1522-3(1957) Dec.

6164

HALF LIFE OF ERBIUM 167 AT 264 kev LEVEL. E. E. Berlovich, K. M. Grotovskiĭ, M. P. Bonits, and G. M. Gorodinskiĭ (Leningrad Inst. of Technical Physics). Zhur. Eksptl'. i Teoret Fiz. 33, 1523-4(1957) Dec. (In Russian)

6165

CONTRIBUTIONS TO THE ISOBAR SERIES 107 AND 108. F. Baumgärtner, A. Plata Bedmar, and L. Kindermann (Gäste der Arbeitsgruppe für Radiochemie in der Physikalischen Studiengesellschaft, Düsseldorf). Z. Naturforsch. 13a, 53(1958) Jan. (In German)

Ru^{103} is formed only by the fission of heavy nuclei and always in conjunction with Ru^{107}. The gamma spectrum of the short-lived Ru fission isotope was investigated. From the lines at 0.22, 0.31, 0.43, 0.57, and 0.8 Mev the lines at 0.31 and 0.57 increased in intensity, behaving as known lines of Rh^{107}. The γ line 0.43 Mev was observed in the 18 sec activity of Rh^{103} and had a half life of 17.5 sec. The half life of the 0.43 γ line in Ru^{103} was measured at 4.4-min. The half life of the 0.22 Mev line was 4.8 min and corresponds to the decay of Ru^{107}. The maximum β energy of Rh^{103} was measured at 3.7 Mev. The maximum β energy of Ru^{107} was observed from 2.3 to 2.4 Mev. (J.S.R.)

6166

THE ISOMERS OF Sb^{126}. I. Fränz and H. Münzel (Arbeitsgruppe für Radiochemie in der Physikalischen Studiengesellschaft, Düsseldorf). Z. Naturforsch. 13a, 53-4(1958) Jan. (In German)

Te^{126} was irradiated with fast neutrons and measured without chemical separation. The analysis of the decay curve gave a half life of 9 hr, 70 min, and 19 min, and several shorter lived and one longer lived activity. From the β absorption curve and the γ spectrum it was determined that the 9 hr and the 70 min isotopes corresponded to Te^{127} and Te^{129}. The activity decaying in 19 min had strong γ lines at 650 and 420 kev and corresponded to a previously isolated 18.8 min Sb activity. The 128 and 130 isotopes of Sb could not be identified. It appeared that the 18.8 min Sb was formed by a (n,p) process from Te^{126} and had a mass number of 126. The strong γ lines of the 18.8 min Sb corresponds with those from a previously reported 6 day Sb^{126} isomer. (J.S.R.)

Nuclear Reactors

6167 AECD-3773

Argonne National Lab., Lemont, Ill.

MATERIALS TESTING REACTOR PROJECT. SITE PLAN. Design Report No. 36. R. F. Guzik and L. E. Link. May 3, 1950. Changed from OFFICIAL USE ONLY Jan. 24, 1957. 13p. Contract [W-31-109-eng-38]. $3.30(ph OTS); $2.40(mf OTS).

A reactor of the size and having the purposes of the MTR has a number of auxiliary functions which must be provided for. In addition to the building housing the reactor these include four separate types of water systems, a canal for storage and disposal of spent fuel assemblies, a steam plant, an air cooling and exhaust system, laboratory facilities, quarters for administrative personnel, quarters for maintenance and protection staffs, and waste disposal facilities. For various reasons it is not practical to consolidate all these functions into one building, or a few buildings, hence they are divided, and in some cases combined, into various "areas" and/or buildings. In addition, there are two gate houses, perimeter fences and lights, patrol and service roads, sidewalks, and the usual utilities such as electricity, sewers, telephones etc. With the reactor and its building as a nucleus, these

areas are arranged into a "site plan" wherein the best possible locations are made for all functions, subject to a number of important governing factors as outlined in detail. (auth)

6168 AECU-3624

Michigan. Univ., Ann Arbor. Engineering Research Inst.
DESIGN OF MTR FUEL-ELEMENT-SOURCE SHIPPING CASK FOR RAILWAY MOBILE IRRADIATION FACILITY. Progress Report. L. E. Brownell, J. Patterson, and S. N. Purohit. Sept. 1957. 46p. Contract AT(11-1)-162. (ERI-1943-8-101-P). $7.80(ph OTS); $3.30(mf OTS).

The γ-radiation field from a battery of 10 MTR spent fuel elements was calculated and a special shipping cask designed to contain the 10 elements. An internal water-cooled tank in the cask holds the 10 elements in the vertical position. Two external air-cooled, finned-tube heat exchangers control the water temperature. The sides of the cask open to convert the cask to a radiation source without changing the position of the elements. A unique feature of the design is a device for closing the sides of the cask by gravity in the event of accident or power failure. This provides a "fail-safe" safety feature. (auth)

6169 AERE-R/R-2346

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A NEW APPROACH TO TWO GROUP DIFFUSION CALCULATIONS FOR HETEROGENEOUS LATTICES. M. C. Hartnell-Beavis and D. Hicks. Aug. 1957. 46p. $1.26 (BSI).

A logical presentation of heterogeneous reactor theory based on the cell method was attempted. The equivalent homogeneous diffusion parameters are shown to be properties of the system as a whole and not of the cell structure only. A treatment of the anisotropy in the macroscopic diffusion coefficient is given. A number of applications of the revised methods are given and it is shown that under certain conditions considerable errors may arise in the conventional treatment. (auth)

6170 AERE-T/M-154

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A MULTIGROUP DIFFUSION THEORY PROGRAMME FOR PLANE SLAB OR SPHERICAL SYSTEMS. P. D. Preston and M. E. Mandl. Jan. 1958. 16p.

This program for the A.W.R.E. Ferranti Mk. I computer solves the multigroup diffusion theory equations for almost any type of system with spherical symmetry. An extra tape converts the program for use with plane slab systems. Besides ordinary critical size calculations, problems with any boundary conditions linear in the flux and current (including a given size for the flux or for the current) can be done. Up to 16 energy groups and 8 different regions can be used and the interval length Δr can vary from region to region. The number of radial points used is 32. An outline of the method used is given and the preparation of the data tape and operation of the program are described. (auth)

6171 APAE-2

Alco Products, Inc., Schenectady, N. Y.
HAZARDS SUMMARY REPORT FOR THE ARMY PACKAGE POWER REACTOR. July 27, 1955. Decl. Apr. 12, 1957. (Includes supplement. Aug. 26, 1955). 292p. Contract AT(11-1)-318. $6.00(OTS).

The APPR-1 is described and the various hazards are reviewed. Because of the reactor's location near the nation's Capitol, containment is of the utmost importance. The maximum energy release in any possible accident is 7.4 million Btu's which is completely contained within a 7/8 inch thick steel cylindrical shell with hemispherical ends. The vapor container is 60 ft high and 32 ft in diameter and is lined on the inside with 2 ft of reinforced concrete which provides missile protection and is part of the secondary shield. All possible nuclear excursions are reviewed and the energy from any of these is insignificant compared to the stored energy in the water. The maximum credible accident is caused by the reactor running constantly at its maximum power of 10 Mw and through an extremely unlikely sequence of failures, causing the temperature of the water in the primary and secondary systems to rise to saturation; whereupon a rupture occurs releasing the stored energy of 7.4 million Btu's into the vapor container. If the reactor core melts during the incident, a maximum of 10^8 curies of activity is released. While it appears impossible for a rupture of the vapor container to occur except by sabotage or bombing, the hazards to the surrounding area are discussed in the event of such a rupture occurring simultaneously with the maximum credible accident. (auth)

6172 APAE-26

Alco Products, Inc., Schenectady, N. Y.
RADIOCHEMICAL ANALYSIS OF CRUD FROM THE ARMY PACKAGE POWER REACTOR. J. L. Zegger, W. J. Small, and W. S. Brown. Feb. 15, 1958. 34p. Contract AT(11-1)-318. $6.30(ph OTS); $3.00(mf OTS).

A study was made of the radiochemical composition and the specific activity of insoluble corrosion products (crud) removed from the primary system of the APPR-1. The results of analysis of twelve crud samples collected during the interval from September 3, 1957 to December 1, 1957 are presented. The samples were radiochemically analyzed for long-lived gamma emitting nuclides only. Data are presented on the measured values of the specific activity of crud, the ratios of the nuclide specific activities, and the concentration of crud (crud level) in the circulating primary water. Also included are data, based on the analysis of a single sample, comparing the specific activity of the deposited and circulating corrosion products. (auth)

6173 CEA-670(A)

France. Commissariat à l'Énergie Atomique, Paris.
PRÉSENTATION DU PREMIER RÉACTEUR A GRAPHITE FRANÇAIS ET DES EXPÉRIENCES EFFECTUÉES EN 1956. (Description of the First French Graphite Reactor and of the Experiments Performed in 1956.) J. Bussac, C. Leduc, and C. P. Zaleski. 1957. 40p.

This paper is an introduction to the experiments performed on the G 1 reactor, experiments fully described in the papers following (670 "B" to "P"). The main results are given together with some comments. The neutronic parameters of the core, a description of the most important structures, and a few words of the tests leading to normal operation of the reactor under load complete our survey. (auth)

6174 CEA-670(B)

France. Commissariat à l'Énergie Atomique, Paris.
LONGUEUR DE DIFFUSION DU GRAPHITE EFFET DES CANAUX CYLINDRIQUES. (Diffusion of Graphite—The Effect of Cylindrical Canals.) R. Carle, C. Clouet d'Orval, R. Lattès, J. Martelly, T. de Mazancourt, C. Robert, M. Sagot, and A. Teste du Bailler. 1957. 19p.

Experiments on thermal neutron diffusion in the graphite used as moderator in the G1 pile have been carried out. The object of these experiments is to determine the intrinsic quality of this graphite, characterized by its diffusion length L or its Laplacian $-1/L^2$ and the effect of the canals, which modifies anisotropically the macroscopic

diffusion equation and is characterized by two principal diffusion regions (or two principal Laplacians) valid respectively for the diffusion in the direction of the canals and in a perpendicular direction. In order to determine them, two experiments are necessary, in which the second derivatives of the flux in relation to the space coordinates are very different. These experiments form the object of the first two parts. In Part I the diffusion along the axis of a flux coming from the pile and limited radially by a quasi-cylindrical screen of cadmium bars is discussed. This screen or "Faraday cage" is designed to give to the thermal flux the same radius of extrapolation to zero as that of the pile source. The determination of L (with the graphite full) has been made under the same conditions. The measurements have been interpreted in two ways. The influence of the brackets holding the detectors is discussed. The radial diffusion in the graphite surrounding the "long" cylindrical pile is well described by a sum of Bessel functions. The results (valid for d = 1.61 and T = 17°C) are for the graphite without cavity L = 52.7 ± 0.4 cm. The effect of the canals on the diffusion area and its anistropy are in excellent agreement with the theory of Behrens. The theory of the Faraday cage is given in the appendix. (auth)

6175 CEA-670(C)
France. Commissariat à l'Énergie Atomique, Paris.
TAILLES CRITIQUES ET CARTES DE FLUX A FROID. (Critical Size and Flux Distributions in the Shut Down Pile.) A. Banchereau, P. Berthier, J.-P. Genthon, C. Gourdon, R. Lattès, J. Martelly, R. de Mazancourt, L. Portes, M. Sagot, A.-P. Schmitt, P. Tanguy, A. Teste du Bailler, and A. Veyssière. 1957. 29p.

An important part of the experiments carried out on the reactor G1 during a period of shutdown has consisted in determinations of critical sizes, and measurements of flux distribution by irradiations of detectors. This report deals with the following points: critical sizes of the flat pile, the long pile, and the uranium–thorium pile; flux charts of the same piles, and study of an exponential experiment; determination of the slit effect; calculation of the anisotropy of the lattice; and description of the experimental apparatus of the irradiation measurements. (auth)

6176 CEA-670(D)
France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDE DE RÉSEAUX MIXTES URANIUM–THORIUM. (A Study of Uranium–Thorium Mixed Lattices.) P. Bacher, R. Eckert, and R. de Mazancourt. 1957. 11p.

Some subcritical experiments have been carried out during the charging of the G 1 pile by introducing thorium bars in a regular lattice into the pile. The spreading out of these experiments over a period of three months has permitted work on a pile gradually increasing in size and measurements on comparable charges in so far that they have either the same number of bars of thorium, or the same concentration of thorium. From the measurements at constant charge and at constant concentration, it is possible by extrapolation to determine the critical charges and concentrations. The values obtained have shown that the material Laplacian of the lattice depends linearly on the thorium concentration and must cancel out for a concentration T = 8.8 ± 0.3 per cent by volume. These results have been found, to a very good approximation, by a simple calculation. (auth)

6177 CEA-670(E)
France. Commissariat à l'Énergie Atomique, Paris.
VARIATION DU LAPLACIEN MATIÈRE DE G I AVEC LE RAYON DU BARREAU D'URANIUM. (Variation of the Material Laplacian of G 1 with the Radius of the Uranium Bar.) P. Tanguy. 1957. 17p.

In this report are described and interpreted some experiments, carried out in the G 1 pile during a period of shutdown, which have made it possible to measure the variation of the material Laplacian of the lattice with the radius of the uranium bar. The variation of the reactivity of the pile is measured when an increasing number of fuel elements are progressively replaced in the central region by fuel elements of greater diameter; it is shown that, starting from measurements based on less than ten per cent of the total number of elements, the variation of reactivity corresponding to the replacement of all the elements can be determined; it is then easy to deduce the variations of the Laplacian. (auth)

6178 CF-56-10-24
Oak Ridge National Lab., Tenn.
HEAT RELEASE IN NUCLEAR REACTORS. L. G. Alexander. Oct. 4, 1956. 36p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Discussions are included on energy sources and modes of local deposition of heat, fission fragment and β decay energy, neutron energy, energy release by β decay of activated nuclei, neutron flux distribution, γ heating calculations, and integration of the γ heating equation for simple cases. (M.H.R.)

6179 CF-58-2-10
Oak Ridge National Lab., Tenn.
PREDICTED SLURRY ACTIVATION IN HRE-3. E. H. Gift. Feb. 6, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The gamma and beta activity of the proposed HRE-3 slurry for blanket operation at 10 Mw has been estimated. The sources of activity were found to be fission-product decay and Pa^{233} decay. The estimated gamma activity of the slurry is plotted, showing the Pa^{233} gammas, four energy groups of fission products, and the total gamma activity for a nearly infinite irradiation time. For the same conditions, the estimated beta activity of the slurry is plotted, showing the Pa^{233} betas, the fission product decay betas, and the total beta activity. (auth)

6180 GAT-DR-275
Goodyear Atomic Corp., Portsmouth, Ohio.
REFLECTOR SAVINGS FOR HOMOGENEOUS AQUEOUS SOLUTIONS OF U-235. John A. Pond. Feb. 6, 1958. 30p. Contract [AT(33-2)-1]. $6.30(ph OTS); $3.00(mf OTS).

Experimental data from critical systems were used to calculate extrapolation lengths for bare reactors and reflector savings for reflected reactors. A modified two-group theory is used with changes suggested by work of Trubey et al. (M.H.R.)

6181 HW-44703(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PROGRAM STUDY REPORT PLUTONIUM FUEL CYCLE. F. W. Albaugh and R. M. Fryar. July 30, 1956. Decl. with deletions Apr. 10, 1957. 80p. Contract W-31-109-Eng-52. $2.25(OTS).

To ascertain the type of reactor that would most nearly fulfill the objectives of the program, four different reactor concepts were investigated. These conceptual designs are: a D_2O moderated reactor, a graphite moderated prototype reactor, an H_2O moderated tank type reactor, and a graphite moderated fringe-driven reactor. Engineering data and preliminary estimates on design, cost, and schedule are presented for each type. The D_2O reactor is believed to be the source of maximum benefits. (M.H.R.)

6182 IDO-16431
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ENGINEERING LIAISON FOR MTR-ETR EXPERIMENTS STANDARD PRACTICES MANUAL. R. J. Nertney, ed. Dec. 20, 1957. 58p. Contract AT(10-1)-205. $1.50(OTS).

The need for and nature of these guides are discussed in general terms. The presently proposed guides (including those which are completed) are briefly abstracted. The experiment information outlines, which are prepared for each major engineered experiment at the MTR are discussed, and sample outlines are included in the appendices. (auth)

6183 IGC-TRCWP/Misc-1

Gt. Brit. Dept. of Atomic Energy. Industrial Group H. Q., Risley, Lancs, England.

REF:- NEUTRON SOURCES FOR THERMAL REACTOR. J. H. Bowen. Oct. 21, 1954. 5p.

It is proposed to provide neutron sources for the Thermal Reactor, their function being to maintain the neutron flux in the reactor, at a value which can be reliably detected even when nominally "shut down." The design uses the (gamma-neutron) reaction in Be with Te^{124} as the γ source material. The Te is produced by pile neutron irradiation of Sb^{123}, which comprises about half of natural Sb, the predominant Sb–Te decay having a 60 day half life with high energy (1.7 Mev) gammas. Calculations on the effectiveness of the source shown in Sk 18355 give the reactor power as 2 watts with a K of 0.95, the absorption of the source being $3.3\ 10^{-4}$ in k. Four sources placed in a flux equal to $\frac{1}{4}$ the central intensity would produce approximately the same number of neutrons, but with only $\frac{1}{4}$ the absorption of k. It is therefore proposed to supply four sources of this design per pile, and to determine their most suitable positions at the time of U loading. A neutron source will probably be required for the lattice and criticality experiments preceding initial startup. The permanent sources would be clumsy to use for this purpose, so it is proposed not to pre-irradiate them before loading, but to use a temporary Ra–Be source for the experiments. At the first startup the pile will therefore diverge at a power of a few m-w and there will not be the same continuity of measurement as when the source is working. Special care will be required for this initial startup. (auth)

6184 KAPL-M-ER-2

Knolls Atomic Power Lab., Schenectady, N. Y.

DOSE RATES ON THE S3G/S4G BOILER AND PRIMARY COOLANT PIPING AFTER SHUTDOWN. E. J. Romesberg. Feb. 18, 1958. 30p. Contract W-31-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

The expected dose rates on the S3G/S4G boilers and piping 15 minutes after shutdown are given. Sources of radioactivity are deposited crud, water impurities, and fission products dissolved in the primary coolant. Dose rates were calculated and plotted in terms of source strength and the present magnitudes of sources were included. (auth)

6185 KAPL-M-OAC-1

Knolls Atomic Power Lab., Schenectady, N. Y.

TRIXY, A THREE-DIMENSIONAL MULTIGROUP CODE: INPUT PREPARATION. Ouida A. Clendinning. Jan. 29, 1958. 45p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

Preparation of input for TRIXY, a three-dimensional multigroup calculation for the IBM 704, is described. A brief description of the equations is included. (auth)

6186 KAPL-M-PB-3

Knolls Atomic Power Lab., Schenectady, N. Y.

A GENERALIZED APPLICATION OF THE DIGITAL COMPUTER TO THE REACTOR RADIOACTIVE ACCESSIBILITY PROBLEM. A. P. Bray. Dec. 6, 1957. 58p. Contract W-31-109-Eng-52. $10.80(ph OTS); $3.90(mf OTS).

In the past a radioactive accessibility investigation of the primary coolant system was very complex unless many simplifying assumptions were made and unless many transport mechanisms were neglected. The investigation was very complicated and this fact discouraged any form of complete parameter or mechanism study in connection with radioactive accessibility. In this analysis a generalized flow diagram applicable to the primary loop of any reactor system is developed, the defining differential equations of this loop are written and an IBM-704 code is developed and applied to these developed equations. Variation of the flow diagram and variation of the transport mechanisms are discussed. The analysis and code are general and are therefore a useful tool in a variety of parameter and mechanism studies in connection with the radioactive accessibility problem. (auth)

6187 KAPL-M-RES-49

Knolls Atomic Power Lab., Schenectady, N. Y.

MIXING IN PLENUMS. H. F. Larkin. Sept. 1957. 27p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Data for estimating the mixing in a plenum by turbulent diffusion was developed and plotted on a series of curves. The mixing effectiveness of a plenum cannot be calculated unless the plenum is quite simple. The best estimates of plenum mixing are obtained from empirical data or judgement based on previous test experience. If a plenum varies significantly from plenums for which data are available it is recommended that tests be run to determine mixing if this is to be an important feature of the plenum. It is proposed to give some insight into plenum mixing based on air and water test experience so that those less familiar with the mixing physical picture can more effectively design for mixing when necessary. (auth)

6188 KAPL-M-SMS-86

Knolls Atomic Power Lab., Schenectady, N. Y.

S4G AIR-BORNE FISSION PRODUCT ACTIVITY IN THE EVENT OF A PRIMARY TO SECONDARY LEAK. Eric Nordgren. Jan. 13, 1958. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

An attempt is made to determine the hazard presented by fission product gases from a cladding break; how large a cladding break can be endured; how long it takes for dangerous activity to be reached; and how effective degasification and surface ventilation are in controlling the problem. (M.H.R.)

6189 MT-36

National Research Council of Canada. National Research Labs., Ottawa.

THE PREDICTION OF PIPELINE PRESSURE LOSSES WITH URANIUM TRIOXIDE SUSPENSIONS. E. H. Dudgeon and W. C. Michie. Nov. 1957. 58p.

Measurements of pipeline pressure losses for UO_3 aqueous suspensions were made for two pipe diameters and a range of velocities, oxide concentrations, and temperatures. These results were correlated using shear rate-shear stress information obtained from a specially designed rotational viscometer. The effect of pumping at high shear rates on the chemical and physical stability of the oxide has been investigated. The limiting velocity to avoid settling in a 1.85-inch diameter pipe was measured. (auth)

6190 NAA-SR-276(Del.)

North American Aviation, Inc., Downey, Calif.

REACTOR SAFETY QUARTERLY PROGRESS REPORT [FOR] MAY–JULY 1953. N. E. Huston, ed. Oct. 20,

1953. Decl. with deletions Mar. 4, 1957. 16p. Contract AT-11-1-GEN-8. $3.30(ph OTS); $2.40(mf OTS).

Progress is reported in preliminary studies of solder-plug-type trigger elements, diaphragm ruptures, and a continuation of the coating studies. The investigations of solder plugs have indicated that the extrusion of the plug under a continual pressure loading is not as serious a problem as anticipated. The diaphragm studies have shown that rupture of a pressure-loaded diaphragm initiated by penetration of a sharpened plunger is not a desirable mechanism for the safety device. This is because the diaphragm must be loaded almost to the bursting pressure to have the plunger penetration yield a complete rupture reliably. The feasibility of effecting a reactor shutdown by chemically plating Cd metal from a Cd chloride solution onto the coolant channel surfaces has been demonstrated for clean Al. The deposited oxide film that accumulates on the tube surfaces under actual Hanford flow conditions will probably present a major problem for this system. Two analytical studies have progressed to the final stages of the first phase. The fundamental reactor-transient studies are now in the solution stage. These will serve as bases for further studies that will include such parameters as the time for complete loss of coolant to occur, poison introduction time, and other variables affecting the reactivity. These studies will be used to define a most hazardous incident with and without the safety device. The first part of the transient coolant flow studies are also in the solution stage. This part provides steady-state flow rates, for both water and water-steam conditions, as a function of power generation and front header pressure. (auth)

6191 NAA-SR-2323

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ORGANIC MODERATED REACTOR EXPERIMENT SAFEGUARDS SUMMARY. H. L. Sletten, ed. Feb. 1, 1958. 139p. Contract AT(04-3)-88. $3.75(OTS).

Originally issued July 9, 1956 as NAA-SR-Memo-1667.

A description is presented of the Organic Moderated Reactor Experiment (OMRE), of the hazards associated with this experiment, and of the safe-guards taken to ensure the safety of the operating personnel and the population of the surrounding area. The OMRE facility is located at the National Reactor Testing Station at Arco, Idaho. It includes the reactor, its cooling system, and auxiliary equipment, as well as the buildings and services associated with the installation. It is to operate for one year and provide the information required to determine the feasibility of the concept of using a hydrocarbon as moderator, reflector, and coolant in a nuclear reactor under conditions of exposure to heat and radiation of interest in the generation of useful power. Various extreme accidents and hazards and their possible consequences are analyzed, and the safety measures taken to prevent their occurrence are described. It is concluded that even in case of the most improbable and most extreme credible accident, the OMRE will not constitute a hazard to the population of the surrounding area. (auth)

6192 NDA-084-3

Nuclear Development Corp. of America, White Plains, N. Y.

SDR PROJECT QUARTERLY TECHNICAL PROGRESS REPORT FOR THE PERIOD AUGUST 1, 1957 THROUGH OCTOBER 31, 1957. Dec. 31, 1957. 52p. Contract AT(30-3)-256. $7.80(ph OTS); $3.30(mf OTS).

Engineering design and experimental studies have been continued, with the objective of demonstrating the feasibility of separating Na and D_2O in the Sodium Deuterium Reactor (SDR). Fabrication methods for manufacturing SDR fuel-coolant tubes were examined; there is every indication that the design is feasible, and a good possibility that the tube can be formed in one piece, without welds. D_2O calandria design was backed up by visits to Chalk River and Savannah River. A modified barrier arrangement has been studied and will be evaluated further. A Na leak detection system has been outlined. Detailed design is proceeding on both static and fatigue rigs for testing the mechanical integrity of fuel-coolant tube and header joints. Screening tests on barrier materials were essentially completed, using the single-failure test apparatus at the NDA Pawling Laboratory. Results on Al were especially encouraging; two samples of 0.060-in. thick Al were exposed to a jet of 950°F Na for more than 16 hr, and both survived. Design work has been completed, and fabrication is now proceeding, on the multiple-failure test apparatus, in which both H_2O and Na system failures can be simulated at the same time. Detailed design is progressing on the mock-up test, which consists of three fuel-coolant tubes and associated barriers in a tank of water; this test will be used to demonstrate the reliability of integrated Na and H_2O circulating systems under simulated reactor operating conditions. Additional analysis was done on the straight-through configuration, for two types of fuel elements—a U–Mo alloy, and UO_2. An alternative design concept, based on a slab configuration, was also studied; the slab design has some potential maintenance and safety advantages as compared with the calandria (or lattice) configuration. Shielding studies continued to concentrate on after-shutdown radiation levels in the header rooms. (For preceding period see NDA-84-2.) (auth)

6193 NP-6588

MSA Research Corp., Callery, Penna.

PROGRESS REPORT NO. 44 FOR DECEMBER 1957 AND JANUARY 1958. W. J. Posey, ed. Feb. 17, 1958. 24p. Contract NObs-65426.

Progress is reported in the following studies: A1W hydrodynamic test; film boiling with water inside tube; simulation of vapor venting to sea water; chromate formation in high-temperature water systems; radioactivity associated with crud particle size ranges; and fission product release during core meltdown. (For preceding period see NP-6548.) (W.L.H.)

6194 ORNL-2318

Oak Ridge National Lab., Tenn.

REACTOR SAFETY SYSTEM RESPONSE. F. P. Green, ed. Feb. 14, 1958. 103p. Contract W-7405-eng-26. $2.75(OTS).

A collection of papers presented at the Third Annual Meeting of the American Nuclear Society, June 10, 1957, by the Reactor Controls Department.

Reactor accidents are discussed which might be caused by failure of the control system. A second group of accidents, not caused by controls, can be mitigated by a fast safety system. Factors are enumerated which govern the realization of a fast safety system. A pulse method for determining magnet release time in a field installation is described. The basic principles of electromagnet design are reviewed, with special emphasis on the factors which affect release time and an experimental evaluation of the performance of solid and slotted pole electromagnets used in research reactors is presented. The results of tests on determination of entering velocities of a control rod of the BSF type are described. An analysis of the corrective action provided by insertion of safety rods when a reactor is on a fast period was made for a specific reactor by analog computer simulation. (M.H.R.)

6195 TID-7529(Pt. 1)
Nuclear Development Corp. of America, White Plains, N. Y.
REACTOR HEAT TRANSFER CONFERENCE OF 1956. Collected Papers and Reports of a Conference Held at New York, November 1 and 2, 1956. John E. Viscardi, comp. Nov. 1957. (Issued in two books: (Bk. 1), 323p. and (Bk. 2), 318p.) $7.76(OTS).

Papers included in Book 1 cover: a general method of determining the total time interval of transients in linear systems, the basic equations describing energy flow and pressure drop relationships for transient coolant flow conditions in a nonhomogeneous plate-type reactor, rapid flow transients in closed loops, fast transient heat transfer in a clad element–stagnant H_2O system, transient heat conduction in solid cylindrical nuclear fuel elements, the response of a nuclear reactor coolant to power transients, a transient thermal analysis by means of analog computers, an analysis of fuel-plate temperature rise during a burnout transient, in-pile molten metal-water reaction experiments, pressure drop in rectangular channels at 2000 psia, flow redistribution due to boiling in a matrix, an investigation of burnout heat flux, nucleate and film boiling due to repetitive pulse heating of small wires immersed in H_2O, tubular vs. plate fuel elements: heat transfer and flow analysis, heat transfer within the cores of circulating-fuel reactors, heat transfer and hydraulic characteristics of the SRE fuel element, and heat transfer rates to cross-flowing Hg in a staggered tube bank. Papers included in Book 2 are on: heat transfer to Pb–Bi in turbulent flow in an annulus, pool-boiling heat transfer with Hg, heat transfer investigations of polyphenyl coolants, heat transfer in a radial spray chamber, the dependence of the heat transfer coefficient on the ratio of the heat fluxes from the walls of parallel plane flow channels, heat transfer and pressure drop characteristics of wire-coil-type turbulence promoters, an analysis of axial turbulent flow and heat transfer through banks of rods or tubes, heat transfer from parallel rods in axial flow, high-temperature heat transfer to a gas flowing in heat-generating tubes with high heat flux, the use of the Mach-Zehnder interferometer in heat transfer studies, compact tubular heat exchangers, and temperature and flow distribution in air-cooled reactors. Discussions are included from the working conferences on the following subjects: two-phase flow pressure drop, burnout in natural and forced convection, heat transfer performance of reactor systems utilizing solutions, suspensions and slurries as fuel-bearing fluids, fused-salt heat transfer systems, transient boiling heat transfer and fluid flow characteristics, and analog and digital computer techniques useful in core heat transfer studies. (M.H.R.)

6196 TID-7543
Brookhaven National Lab., Upton, N. Y.
MINUTES OF THE FIFTH TRIPARTITE INSTRUMENTATION CONFERENCE, BROOKHAVEN NATIONAL LABORATORY, OCTOBER 22-26, 1956. 184p. (RIB-21). $3.00 (OTS).

Papers are included on trends and recent developments in reactor instrumentation and control, principles of reactor safety systems, recent advances in reactor instrumentation in England, the safety system and associated instrumentation of a Na-cooled power reactor, the NRU control system, some non-nuclear measurements on the Calder Hall Plant, the Shippingport Pressurized Water Reactor instrumentation equipment, process instrumentation in the Sodium Graphite Reactor system, a subcritical monitor, a gamma monitor, recent advances in reactor instrumentation in England, log Beckman and pile period circuit, the transient behavior of a reactor fuse mechanism in a simulated reactor excursion, a safety system for the Brookhaven National Laboratory Medical Reactor, nondestructive testing of reactor components, chemical plant instrumentation, a continuous analyzer for U or Pu in radiochemical plant streams, a γ absorptometer, a fission counter, KAPL process activity in instrumentation, dosimetry studies at the Brookhaven Cosmotron, radiation monitors, advances in Hanford health physics instrumentation, Harwell health physics instrumentation, an NYOO instrumentation report, monitors for airborne Pu, recent Harwell instrumentation, a transistorized time-of-flight analyzer with a ferrite core, a 1024-channel time delay analyzer, panel labeling, dosimeters, a spark counter α particles, photomultiplier work, developments in actinillation spectrometry and associated circuitry, a single channel pulse height analyzer, work at Chalk River, cold cathode count-rate circuits, a data printer, a new period meter circuit, and reliability. (M.H.R.)

6197 WAPD-BT-5
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. Dec. 1957. 151p. Contract AT-11-1-GEN-14 and appropriate NObs Contracts. $2.75(OTS).

Discussions are included on functional requirements governing design and arrangement of the Shippingport Atomic Power Station, the control of radioactive material at Shippingport, the Expended Core Facility, the Bettis Plant Thermal and Hydraulics Laboratory, training operating personnel for nuclear power plants, design and operating characteristics of a bed filter for an in-pile test facility, a test report on the Fischer and Porter spring balanced float-type flowmeter, determining performance characteristics of a saturated steam pressurizer for nuclear power applications, a study of the force-deflection characteristics of a Belleville spring, a hydraulic test program for reactor core components, a review of two-phase flow relations, formal heat transfer solutions for reactor design, and transient temperature distribution in pressure vessels. (M.H.R.)

6198 WAPD-MRP-71
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD OCTOBER 24, 1957 TO DECEMBER 23, 1957. 89p. Contract AT-11-1-GEN-14. $2.50(OTS).

Initial criticality, generator synchronization, and full power operation were obtained. The multiport sampling value and all primary system relief valves were installed and checked for operation. Seed-2 design effort was initiated by a water channel and fuel plate thickness optimization analysis. Core-2 design studies were continued. Heat generation and loss-of-flow studies were initiated. X-ray-diffraction analysis of UO_2 reveals that irradiation damage occurs primarily as a result of lattice strains rather than crystal fragmentation. Irradiated clad and unclad samples of the metallic seed core alloy, U-Zr, showed no density changes as a result of a rapid treatment at 700°C. The elimination of pre-etching in the surface treatment of Core-2 fuel plates prevents the formation of an undesirable black surface coating. A modified Ag-base control rod alloy was developed which has better strength properties than the reference Cd–In–Ag alloy; their corrosion properties are similar. Methods of producing laboratory quantities of UO_2 having densities over 96% theoretical were perfected. Experimental equilibrium data on nonstoichiometric UO_2 indicate the UO_{2+x} region may be treated as a solid solution of interstitial oxygen ion in the fluorite structure. Diffusion coefficients of He in UO_2 between 700 and 1000°C indicate an activation energy of

2 kcal/mole for the diffusion process. Core-1 was taken to cold criticality and tests at ambient temperature were completed. (For preceding period see WAPD-MRP-70.) (D.E.B.)

6199 WAPD-PWR-Ph-151
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SLAB EXPERIMENTS. IV. COMPARISON OF SEED TYPES. Frank Feiner. Dec. 1956. 61p. $9.30(ph OTS); $3.60(mf OTS).

Calculations of criticality of a number of seed and blanket slabs were found to agree with experiments within 2% when the effects of heterogeneity of the slab materials are considered. The calculated excess reactivity of a slab, however, agrees with the experimental value within 0.5% in reactivity. This agreement is better than that of the criticality estimate because the excess reactivity is calculated by a method which cancels the effects which make the criticality estimate incorrect. That is, it involves two criticality calculations, both of which are wrong; but the ratio of the two results is correct. The model on which the calculations are based assumes flux separability into three orthogonal components. Using this same assumption in analyzing experimental data leads to the conclusion that the change of reactivity with height of a slab is dependent only on height, and hence the excess reactivity may be obtained from an integration of the worth; i.e.,

$$\rho = \int_{H_1}^{H_2} \delta\rho/\delta z \, dz.$$

Another consequence of this model is that a plot of the experimental worth values, $(\delta\rho/\delta z)^{-\frac{1}{2}}$ versus H, should be a straight line. The fact that the data do lie on such a line lends weight to the validity of the model. (auth)

6200 WAPD-T-549
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PROBLEMS IN DESIGN OF CONTROL ROD DRIVE MECHANISMS FOR PRESSURIZED WATER REACTORS. John J. Gertz and James W. Flaherty. Oct. 28, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

The design of control rod drive mechanism for nuclear power reactors of the pressurized water type is dependent upon the functional requirements, as outlined by the core and general systems designers. Several of the mechanism design parameters and their relationship to the over-all reactor plant are discussed. Coverage of the subject matter is directed toward improved liaison between the over-all reactor designer and the mechanism designer. (auth)

6201 WAPD-TH-326
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
REVISED PRESSURE DROP RECOMMENDATIONS FOR PRESSURIZED WATER REACTOR DESIGN. B. W. LeTourneau and N. C. Sher. May 8, 1957. 23p. $4.80 (ph OTS); $2.70(mf OTS).

The status of existing Bettis thermal design criteria was reviewed. New pressure drop information has permitted a revision of pressure drop recommendations previously presented; the criteria and associated equations other than for pressure drop remain unchanged. The new pressure drop design procedures include methods for calculating the following: isothermal friction factors for rectangular channels with varying degrees of rolled surface roughness; heating, local boiling, and bulk boiling pressure drop for rectangular channels at pressures from 1100 to 2000 psia; and entrance and exit losses. (auth)

6202 IGRL-T/D-58
NUCLEAR REACTOR SYSTEM WHOSE REACTIVITY IS VARIED BY VARIATION OF THE LEVEL OF A MODERATOR OR REFLECTOR LIQUID BY A PNEUMATIC METHOD. Translated by R. Forsyth from German Patent No. 1,010,202: Patentee: Kurt Diebner. Dec. 1957. 6p.

A nuclear reactor system is described in which the reactivity can be altered by varying the level of a moderator or reflector liquid. The system consists of two connected vessels, one of which contains the actual reactor while the other acts as a storage tank for the moderator or reflector liquid. The interchange of the moderator or reflector liquid between the two tanks is carried out by means of the difference in their pneumatic pressures. (J.E.D.)

6203
TEMPERATURE AND PRESSURE DISTRIBUTION IN A CYLINDRICAL UNCLAD SUFFICIENTLY LONG CORE. Walter Hage. Atomkern-Energie 3, 49-53(1958) Feb. (In German)

The distribution of the temperature and the radial and tangential pressure in a cylindrical fuel element is calculable with sufficient accuracy for the value $\kappa R<1$ (where κ is the reciprocal diffusion length and R is the fuel element radius). For values of $\kappa R>1$ the error was always greater than 4%, but with simplifications one can be within permissible limits. With values of $\kappa R>3$ however, the error is between 20 and 40%, so that under these conditions the heat source distribution corresponding to the thermal neutron flux should be considered. (tr-auth)

6204
SOME ASPECTS IN THE DESIGN OF A PRESSURIZED WATER REACTOR FOR A SHIP. H. G. Bachmann. Atomkern-Energie 3, 53-5(1958) Feb. (In German)

The influence of the fuel element form and arrangement on the temperature distribution in the core was investigated for a pressurized water reactor for the propulsion of a ship. (J.S.R.)

6205
THE QUESTION OF A THERMAL PLUTONIUM BREEDER. H. J. Brüchner. Atomkern-Energie 3, 56-9(1958) Feb. (In German)

The use of a two-stage reactor for the breeding of Pu^{239} is discussed. The formula for the initial conversion ratio is derived and a value of $R_1 = 1.231$ is obtained for a U^{235} concentration of 7.7% in the first stage and 0.714% in the second stage. (J.S.R.)

6206
THE HOMOGENEOUS REACTOR. G. Perona and I. Casagrande. Energia nucleare (Milan) 5, 27-32(1958). (In Italian)

The choice of a type of reactor more suitable to produce energy in particular work conditions is one of the most difficult problems to the nuclear engineer. Among reactors, the homogeneous one has certainly some very interesting prerogatives which are discussed in this paper, after a brief review of the general characteristics. (auth)

6207
SOLID GRAPHITE REACTORS. G. Vacchelli. Energia nucleare (Milan) 5, 33-6(1958). (In Italian)

In this paper it is demonstrated how, together with the good quality of an advanced technology, sodium-graphite reactors present the fault of some partially surpassed criteria from the point of view of a nuclear engineer. It then seems rather improbable that sodium-graphite reactors will be used, at least in their present form, as will other technologically simpler types. (auth)

6208
LIQUID METAL FUEL REACTORS. E. Cerrai. Energia nucleare (Milan) 5, 37-44(1958). (In Italian)

In this paper the author describes and comments on the information and news concerning the problems connected

with this type of reactor and the various solutions brought in up till now. (auth)

6209

ORGANIC MODERATED REACTORS. L. Orsoni. Energia nucleare (Milan) 5, 45-50(1958). (In Italian)

The characteristics of this type of reactors are described. The organic moderator reactor can be considered a perfectioning of the water pressurized one. As it is the result of the experience of operation of the prototype (OMRE), it seems most encouraging from many points of view, particularly as far as safety is concerned. (auth)

6210

HEAVY WATER MODERATED REACTORS. S. Finzi. Energia nucleare (Milan) 5, 51-9(1958). (In Italian)

In this paper differences and likenesses between light water or graphite moderated reactors and heavy water reactors are described. It is pointed out how the latter allows and encourages the use of natural uranium. The main characteristics that can be obtained with a heavy water moderated nuclear reactor and the principal cooling fluids, with which heat can be drawn from them, are considered. (auth)

6211

NEUTRON POISON BY GASEOUS FISSION PRODUCTS. P. C. Davidge and C. J. L. Lock (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy 6, 191-6(1958).

Calculations have been made of the neutron poisoning caused by gaseous fission products produced under various reactor operating conditions. In particular, the merits of removing the gaseous fission products iodine and bromine, as a means of partial depoisoning, have been considered. It is concluded that if the delay time before removal of the halogen is less than 1 hr, the poison level would be acceptable even after a long period of reactor operation. (auth)

6212

SLOW-NEUTRON SPECTRUM MEASUREMENTS FROM THE SWEDISH HEAVY-WATER REACTOR, R1. K. E. Larsson, R. Stedman, and H. Palevsky (AB Atomenergi, Stockholm). J. Nuclear Energy 6, 222-32(1958).

During the last few months a slow chopper with associated time-of-flight equipment has been put into operation at the Swedish reactor, R1. The first task was to determine the shape of the slow neutron spectrum in the wavelength region from 0.85 to 11 A. The spectrum of the slow neutrons emerging from an experimental hole is best fitted with a function which is nearly Maxwellian in shape $dn = \text{const.}\ \lambda^{-4.07} \exp -[(\lambda_0/\lambda)^2]\, d\lambda$, where $\lambda_0 = 1.66_5$ A and corresponds to a neutron temperature of (341 ± 10)°K. The moderator temperature on the same occasion was 298°K. In subsidiary measurements it has been shown that the percentage of neutrons below the Be cut-off at 4 A is 5% of the total slow neutron spectrum, in agreement with the velocity distribution data. At a reactor power of 600 kw the flux of thermal neutrons below the cadmium cut-off at the exit of this experimental channel of radius 12 cm is 3.4×10^5 n/cm² sec, the flux below the Be cut-off being about 1.3% of this or 4.4×10^6 n/cm² sec. (auth)

6213

RESONANCE ABSORPTION IN A CLOSE-PACKED LATTICE. G. V. Petrov. J. Nuclear Energy 6, 251-4(1958).

One of the most important quantities determining the possibility of a chain reaction in a uranium-moderator system is the probability of resonance absorption in U^{238} of neutrons slowing down from fission to thermal energies. In this paper the expression of Gurevich and Pomeranchuk for resonance absorption in a lattice of small fuel elements is generalized to the case of a close-packed lattice. The absorption caused by multiple crossing of fuel elements by a neutron is taken into account. The expression derived differs from that given by Gurevich and Pomeranchuk in the term for the blockaded part of the absorption, and the two terms are compared graphically. (auth)

6214

THE CALDER HALL GRAPHITE STRUCTURE. E. Long (UKAEA Industrial Group HQ, Risley, Eng.). Nuclear Power 3, 58-63(1958) Feb.

The use of graphite for all structure in the Calder Hall Reactor core presented several novel engineering problems. The design of the graphite structure so as to compensate for thermal expansion, Wigner growth, and neutron leakage is described in some detail. (J.S.R.)

6215

NUCLEAR HEAT. A SYMPOSIUM ON UTILIZATION PROSPECTS. C. M. Nicholls (AERE, Harwell, Eng.). Nuclear Power 3, 64-6(1958) Feb.

The utilization in Great Britain of nuclear heat is discussed, and the technological difficulties described. Possible uses by the chemical, coal, and gas industries and in water distillation are reviewed. (J.S.R.)

6216

IS FUEL REPROCESSING NECESSARY? FOR CANADA THE ANSWER SEEMS TO BE 'NO'. W. B. Lewis (Atomic Energy of Canada, Ltd.). Nuclear Power 3, 69-70(1958) Feb.

As Canada has abundant natural U deposits and proposes to build high-burnup, heavy water reactors, the reprocessing of fuel is not essential to meeting the power needs of Canada in the foreseeable future. Spent fuel processing and recycling is of interest only for possible future needs and to maintain the technology. (J.S.R.)

6217

MEASUREMENTS OF THE CONVERSION RATIO OF THE PWR CRITICAL FACILITY BLANKET. W. Baer, M. J. Galper, and N. Carbone (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 3, 113-28(1958) Feb.

A series of measurements of the conversion ratio of the PWR blanket has been performed. The experimental techniques and results are described, and a comparison of those results is made with theoretical calculations. The results indicate an average PWR blanket conversion ratio of approximately 1.15. (auth)

6218

COUPLED FAST-THERMAL POWER BREEDER. Robert Avery (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 129-44(1958) Feb.

Coupling a fast and thermal assembly in a power breeder reactor affords the possibility of obtaining the relatively long neutron lifetime characteristic of a thermal assembly and the high breeding ratio characteristic of a fast assembly. General properties of such mixed systems are discussed. A suggested design is discussed and compared with a prototype all-fast system. The coupled system considered consists of a 400-liter Pu^{239} fueled, Na-cooled, fast core surrounded by a 10-cm inner blanket annulus containing natural U, Na coolant, and structural material, but no moderator. Outside the inner blanket is a 30-cm annulus of Be surrounded by an outer blanket consisting primarily of depleted U. The inner blanket serves as core for the thermal system, as barrier for low-energy neutrons between moderator and fast core, and as reflector for the fast core. Its construction is essentially the same as the first part of the blanket in a fast power breeder, so that the transition from an all-fast system to the coupled system involves only the replacement of blanket material by moderator and the use of natural rather than depleted

uranium in the inner blanket. The properties of the system described are thereby changed: neutron lifetime increases from $\sim 1.5 \times 10^{-7}$ sec to $\sim 2 \times 10^{-5}$ sec; breeding ratio reduced ~10%; fast core critical mass decreased ~10%; multiplication constant of the system without the contribution of thermal fissions ~0.95; thermal fissions generate ~13% of total power; and the radial power distribution in fast core flattened, maximum to average ratio reduced from ~1.5 to ~1.3. (auth)

6219

THE PRODUCTION OF N^{16} AND N^{17} IN THE COOLING WATER OF THE NRX REACTOR. W. J. Henderson and P. R. Tunnicliffe (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nuclear Sci. and Eng. 3, 145-50(1958) Feb.

Measurements have been made of the fast neutron cross sections for the production of N^{16} and N^{17} in the uranium rod cooling water of the NRX reactor by the reactions $O^{16}(np)N^{16}$ and $O^{17}(np)N^{17}$. The N^{16} and N^{17} were detected by their gamma and fast neutron activities, respectively, in a continuously flowing sample of the effluent water from a uranium rod. The cross sections (fission neutron spectrum) for the reactions $O^{16}(np)N^{16}$ and $O^{17}(np)N^{17}$ are $1.85 \pm 0.15 \times 10^{-2}$ millibarns and $9.3 \pm 0.9 \times 10^{-3}$ millibarns, respectively. (auth)

6220

A STUDY OF THE EQUILIBRATION PROCESS IN THE FAST EXPONENTIAL EXPERIMENT. W. A. Reardon and H. H. Hummel (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 201-13(1958) Feb.

The failure to obtain agreement between the calculated and measured reflector savings in the Fast Exponential Experiment led to a study of the processes involved in obtaining spectral equilibrium in small, highly enriched systems. It was shown that the length of the equilibrium region was a sensitive function of the pedestal thickness and could be optimized for this assembly. Factors which were found to be significant are, as expected, the geometry and the spectrum of the source. Both the experimental results, and the theoretically derived results are presented. The methods of collecting data and the methods of data analyses which proved most fruitful are also presented. (auth)

Nuclear Transformation

6221 AERE-R/R-2366

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE (n,2n) CROSS-SECTION OF Th^{232} FOR FISSION NEUTRONS. J. A. Phillips. Aug. 1957. 18p. $0.54(BSI).

The mean value of the (n,2n) cross section of Th^{232} for neutrons from U^{235} fission has been determined. Decigram quantities of thorium nitrate were irradiated inside a hollow fuel element in the BEPO reactor. The Th^{233} formed was allowed to decay into Pa^{233}, which was then chemically separated from the thorium together with the fission products. The quantity of Th^{231} produced was found by measuring the intensity of the 25.6 kev γ ray coming from the decay of this isotope using a krypton filled proportional counter. A U^{235} fission foil was used for the intensity calibration of the counter. Ammonium sulfate was used as a flux monitor, the activity of the P^{32} from the threshold reaction S^{32} (n,p)P^{32} giving the flux. A value of 12.4 ± 0.6 millibarns was obtained for the mean value of the (n,2n) cross section of Th^{232} in a fission spectrum. (auth)

6222

THE RANGE-ENERGY RELATION OF Li^8 IONS IN NUCLEAR EMULSIONS. Jean-Pierre Lonchamp and Georgette Robin. Compt. rend. 246, 748-50(1958) Feb. 3. (In French)

Li^8 ions, caused by the reaction of Be bombarded with α particles at 375 Mev, separated magnetically, are traced in a C_2 emulsion. Li^8 is identified by its aspect of "hammer tracks." Nine points of the range-energy curve of Li^8 are determined in the region from 20 to 22 Mev. The curve confirms the one proposed previously by Lonchamp. (tr-auth)

6223

RADIOCHEMICAL STUDIES OF THE REACTION $Si^{30}(p,\pi)Si^{31}$. S. Sekerskii and A. K. Lavrukhina (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.) Doklady Akad. Nauk S.S.S.R. 117, 61-4(1957) Nov. 1 (In Russian)

The dependence of the Si^{31} formation cross section on the energy of the bombarding protons at 120 to 660 Mev was studied. The diagram of silicon decay demonstrates a component with T = 2.6 to 2.7 hr. Measurements of silicon β particle absorption in aluminum showed an energy value of 1.47 Mev which is in good agreement with the available data for Si^{31} and proves the radiochemical purity of the silicon. Calculations show the cross sections for Si^{31} formation do not vary with 120 to 220 Mev protons but increase considerably with proton energies from 220 to 680 Mev. In the reaction the energy of the incident proton is spent on the formation of the π^+ meson and its kinetic energy. Thus, it is evident that the $Si^{30}(p,\pi)Si^{31}$ cross section permits evaluation of the yield of maximum energy π mesons in proton interactions with silicon nuclei. Radiochemical attempts to uncover (p,π^+) reaction for heavier nuclei of Ge and Bi were not successful. (R.V.J.)

6224

THE SHAPE OF THE EXCITATION CURVE FOR THE T(d,n)^{4}He REACTION. V. A. Davidenko, I. S. Pogrebov, and A. I. Saukov. J. Nuclear Energy 6, 258-60(1958).

6225

THE YIELDS OF RARE-EARTH ISOTOPES FROM THE FISSION OF ^{239}Pu BY PILE NEUTRONS. L. M. Krizhanskii, Ya. Malyi, A. N. Murin, and B. K. Preobrazhenskii. J. Nuclear Energy 6, 260-2(1958).

The yields of rare-earth isotopes from the fission of Pu^{239} were determined by mass spectrometry. (A.C.)

6226

EXCITATION CURVES OF THE $N^{14}(d,n)O^{15}$ REACTION. Susumu Morita (Kyushu Univ., Fukuoko). J. Phys. Soc. Japan 13, 126-8(1958) Feb.

The excitation curves of the $N^{14}(d,n)O^{15}$ reaction were measured with a thin plastic scintillator and a pulse height analyzer in the energy range of deuterons from 1.00 to 2.15 Mev. Three excitation functions were obtained at the directions of 0, 90 and 165 degrees (lab. system) with respect to the incident deuterons. The curves obtained at 0 and 165 degrees show remarkable peaks at the deuteron energies, E_d = 1.6 and 1.9 Mev, respectively, while the curve obtained at 90 degrees is nearly flat. (auth)

6227

$Co^{59}(n,\alpha)Mn^{56}$ AND $Mn^{55}(n,\alpha)V^{52}$ REACTIONS INDUCED BY 14.8-Mev NEUTRONS. Isao Kumabe, Eiko Takekoshi, Hiroshi Ogata, Yoshikazu Tsuneoka, and Shinpei Oki (Univ. of Kyoto). J. Phys. Soc. Japan 13, 129-32(1958) Feb.

The angular and energy distributions of alpha particles resulting from $Co^{59}(n,\alpha)Mn^{56}$ and $Mn^{55}(n,\alpha)V^{52}$ reactions induced by 14.8-Mev neutrons were measured with Ilford C2 nuclear plates. As in the case of $Al^{27}(n,\alpha)Na^{24}$ reaction, the angular distributions for the entire energy region are approximately 90° symmetrical and concave upward, and the energy distributions show that the alpha particles with energies below the Coulomb barrier are more emitted

than has been expected. The curves on a semilog plot of the relative level density calculated from the energy distributions of the alpha particles cannot fit a straight line. The total (n,α) cross sections of cobalt and manganese are 84 mb ± 15% and 96 mb ± 15%, respectively. The results are compared with the predictions of the statistical theory of nuclear reactions. (auth)

4228

THE SPECTRUM OF NEUTRONS FROM THE REACTION $p+d \rightarrow p+p+n$. A. T. G. Ferguson and G. C. Morrison (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 41-6(1958) Jan.

The continuous neutron spectrum from the disintegration of deuterium by protons has been measured for proton energies of 3.52, 3.72, and 3.92 Mev. These results are compared with the predictions of the theory of Frank and Gammel. (auth)

4229

THE INTERNAL COMPTON EFFECT. A DETERMINATION OF CROSS SECTION AND ANGULAR CORRELATION. Torsten Lindqvist, Bo-Göran Pettersson, and Kai Siegbahn (Inst. of Physics, Uppsala). Nuclear Phys. 5, 47-57(1958) Jan.

The internal Compton effect, a nuclear transition in which there is a simultaneous ejection of a bound electron and emission of a gamma ray, has been unambiguously demonstrated. The experiment concerned the 662 kev transition in Ba^{137m} and was carried out with a gamma scintillation spectrometer and a beta-ray spectrometer in coincidence. The presence of other effects was carefully considered. The experimental cross section was found to be 1.86×10^{-6} photons in the energy region 97 kev to 120 kev per conversion electron at 90° between the electron and photon directions. Angular correlation experiments were carried out. Comparison with various theories shows that the theory by Spruch and Goertzel does fit the experimental results excellently both regarding absolute cross section and angular correlation. (auth)

4230

THE NUCLEAR REACTION $He^4(\alpha, p)Li^7$ AND ITS INVERSE. I. THE REACTION $He^4(\alpha, p)Li^7$. W. E. Burcham and G. P. McCauley (Univ. of Birmingham, Eng.); D. Bredin and W. M. Gibson (Queen's Univ. of Belfast); D. J. Prowse (Univ. of Bristol, Eng.); and J. Rotblat (Medical Coll. of St. Bartholomew's Hospital, London). Nuclear Phys. 5, 141-8(1958) Jan.

Differentail cross sections for the reaction $He^4(\alpha, p)Li^7$ leaving Li^7 in its ground and first excited state have been measured for an alpha particle energy of 38.5 Mev. The cross sections are in fair agreement with those predicted from the yield of the inverse reaction $Li^7(p, \alpha)He^4$. Under certain simplifying assumptions the partial inelastic cross sections for s and d waves in the reaction $He^4(\alpha, p)Li^7$ are 11 ± 1 mb and 33 ± 3 mb, respectively for the stated incident energy. (auth)

4231

THE NUCLEAR REACTION $He^4(\alpha, p)Li^7$ AND ITS INVERSE. II. THE REACTION $Li^7(p, \alpha)He^4$. Joan M. Freeman, R. C. Hanna, and J. H. Montague (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 148-9(1958) Jan.

The absolute differential cross section for the $Li^7(p, \alpha)He^4$ reaction at 90° has been measured for a number of proton energies between 1 and 1.5 Mev for comparison with results on the inverse reaction $He^4(\alpha, p)Li^7$. (auth)

4232

NEUTRON-INDUCED FISSION OF Ra^{226}. R. A. Nobles and R. B. Leachman (Los Alamos Scientific Lab., N. Mex.). Nuclear Phys. 5, 211-17(1958) Jan.

Energy distributions of single fragments from fission of Ra^{226} by neutrons from 4 to 21 Mev have been observed. The distribution changes from a double peak for 4 Mev neutrons, through unequal double peaks for 8 Mev neutrons, to a single peak for 10 Mev neutrons. The cross section for fission was found to rise from 0.5 millibarns for 2 Mev neutrons to 37 millibarns for 23 Mev neutrons. (auth)

6233

NEUTRON POLARIZATION FROM ELECTRON DISINTEGRATION. M. Suffczyński (Institute of Theoretical Physics, Warsaw). Nuovo cimento (10) 6, 1268-72(1957) Dec.

The polarization of neutrons from disintegration of the deuteron by fast electrons is calculated in dipole approximation. (auth)

6234

DIFFERENTIAL CROSS SECTIONS FOR THE $C^{12}(He^3,p)N^{14}$ REACTION. R. L. Johnston, H. D. Holmgren, E. A. Wolicki, and E. Geer Ilsley (U. S. Naval Research Lab., Washington). Phys. Rev. 109, 884-7(1958) Feb. 1.

The differential cross sections of the three highest energy proton groups from the $C^{12}(He^3,p)N^{14}$ reaction were measured at six angles as a function of incident He^3 energy from 2.0 to 5.0 Mev. Broad resonances were observed at 3.0, 3.6, 4.4, and 4.8 Mev in addition to those previously observed. The angular distributions are rather complex and not easily attributable to either a compound nucleus or a direct interaction. The differential cross sections have been measured at closely spaced angular intervals from 7 to 158 degrees in the center-of-mass system for bombarding energies of 2.0 and 4.5 Mev. (auth)

6235

GAMMA RADIATION FROM N^{14} + d AND C^{13} + d. W. A. Ranken, T. W. Bonner, J. M. McCrary, and T. A. Rabson (Rice Inst., Houston). Phys. Rev. 109, 917-21(1958) Feb. 1.

A magnetic-lens pair spectrometer with 2.5% resolution has been used to study radiations produced by the bombardment of N^{14} and C^{13} by deuterons from a Van de Graaff accelerator. Gamma rays from the bombardment of N^{14} with 4.5-Mev deuterons were observed with quantum energies of 8.321 ± 0.020, 9.07 ± 0.04, 10.03 ± 0.04, and 10.81 ± 0.04 Mev. The detection of radiation from the 10.81-Mev level of N^{15}, in competition with proton emission, indicates a small proton width for this level and an argument is advanced for the assignment of spin and parity values of $\frac{3}{2}^+$ to this state. Gamma rays from the bombardment of C^{13} with 4.5-Mev deuterons were observed with energies of 4.897 ± 0.025, 5.102 ± 0.025, 5.669 ± 0.025, 5.833 ± 0.030 (not Doppler-corrected), 6.090 ± 0.020, 6.419 ± 0.030, 6.700 ± 0.025, 7.012 ± 0.025, and 7.323 ± 0.025 Mev. Experiments were performed which indicate conclusively that the 4.46-Mev γ ray from the bombardment of C^{13} by deuterons is from B^{11}. All γ-ray energies listed have been corected for Doppler shift except where indicated. (auth)

6236

FISSION OF Ra^{226} BY 11-Mev PROTONS. R. C. Jensen and A. W. Fairhall (Univ. of Washington, Seattle). Phys. Rev. 109, 942-6(1958) Feb. 1.

The fission of Ra^{226} by 11-Mev protons has been studied by using radiochemical techniques. The mass-yield curve of fission products shows three humps: a narrow hump centered about mass 112, corresponding to a symmetric fission mode, with two humps on either side, corresponding to an asymmetric fission mode. The measured fission yields of fission fragments at the peaks of all three humps are about the same. The heavy-fragment "wing" of the asymmetric portion of the mass-yield curve is

very similar in position and shape to the corresponding member of other asymmetric mass-yield curves. The light-fragment "wing" has accordingly shifted to lower mass numbers, continuing the trend observed in the asymmetric fission-yield curves of elements heavier than radium. The central, symmetric-fission hump is of the same width as the narrow, symmetric-fission curve observed for fission of bismuth by 20-Mev deuterons. The cross section for fission of Ra^{226} by 11-Mev protons is measured to be $2 \pm 1 \times 10^{-27}$ cm^2, and drops by a factor of about 60 when the proton energy is degraded to 9 Mev. (auth)

6237

AN INVESTIGATION OF THE REACTIONS $^{24}Mg(d,p)^{25}Mg$ AND $^{26}Mg(d,p)^{27}Mg$ BY MAGNETIC ANALYSIS. S. Hinds, R. Middleton, and G. Parry (Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 49-60(1958) Jan.

Angular distributions have been measured of some protons groups emitted from targets of natural magnesium and $Mg^{26}O$ when bombarded by 8.9 Mev deuterons. These distributions have been fitted with curves calculated from the deuteron stripping theories enabling assignments of parities and possible spins to be made to the states of the residual nuclei. The reduced level widths of these states have been calculated in absolute units. Several proton groups were observed corresponding to previously unreported levels in Mg^{25} and Mg^{27}. (auth)

6238

THE REACTION $^{24}Mg(p,\gamma)^{25}Al$ AT THE 418 kev RESONANCE. J. Varma and W. Jack (Univ. of Glasgow). Proc. Phys. Soc. (London) 71, 100-8(1958) Jan.

The 421 ± 4 kev proton capture resonance in Mg^{24} has been studied employing scintillation counters. The resonance has a width of less than one kilovolt, and the relative intensities of the resulting gamma-radiations of energies 2.71, 2.26, 1.81, 1.36, and 0.89 Mev are as 1:1.5:0.4:0.5:2.2 respectively. Coincidence experiments show that the 2.71 Mev level in Al^{25} decays to the ground, 0.453, and 1.81 Mev states. The 1.81 Mev level decays to the ground and first two excited states. The second excited state at 0.94 Mev decays in part through the emission of a 0.49 to 0.45 Mev γ-ray cascade. Measurements of the angular distribution of the gamma rays establish the spin of the resonance level to be $\frac{3}{2}^+$, and the ground state transition to be a mixture of M1 and E2 radiations. The 2.26 Mev transition to the first excited state is probably pure M1. The spin of the 1.81 Mev state is indicated to be $\frac{5}{2}^+$, which is consistent with the results of triple angular correlation measurements of the 0.90 to 1.36 Mev gamma-ray cascade. (auth)

6239

AN INVESTIGATION OF THE $^{16}O(d,\alpha)^{14}N$ REACTION BY MAGNETIC ANALYSIS. A. W. Dalton, S. Hinds, and G. Parry (Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 252-6(1958) Feb.

The $^{16}O(d,\alpha)N^{14}$ reaction has been investigated at bombarding energies of 6.8, 7.1, 7.2, and 8.9 Mev. At these energies the intensity of the transition to the 2.31 Mev, T = 1 state of N^{14} has been measured. Angular distributions have been obtained for the alpha particles leading to the ground state and the 3.95 Mev level of N^{14} for bombarding energies of 6.8 and 8.9 Mev. (auth)

6240

CLOUDY CRYSTAL BALL MODEL FOR NEUTRON REACTIONS AT HIGHER ENERGIES. Mitsuji Kawai, Tokuo Terasawa, and Haruo Ui (Univ. of Tokyo) and Masayuki Nagasaki, Michitoshi Soga, and Yasushi Wada (Tokyo Univ. of Education). Progr. Theoret. Phys. (Kyoto) 18, 66-80 (1957) July.

A systematic analysis using the cloudy crystal ball model of Feshbach, Porter, and Weisskopf is carried out for the total cross sections and the nonelastic cross sections of neutron scattering by nuclei. The energy range considered extends from 3.5 to 14.0 Mev. Almost all the regions of mass number of the target nuclei are covered except for very light ones. The optical potentials assumed are of square well shape. The energy dependence of the potential strength, V + iW, and the mass number dependence of the range of potential, R, are carefully studied. It is found that the mass number dependence of the total cross sections at each of the fixed energies is well reproduced by the calculation with the suitable choice of the potential parameters. On the other hand, the calculation fails to give the correct magnitude of the non-elastic cross sections. The calculated values are considerably smaller than the experimental ones especially for lower incident energies. The parameters which have been found to give the best fit to the experimental data are as follows: $R = (0.5 + 1.35\ A^{1/3}) \times 10^{-13}$ cm, V = 40 Mev for all the neutron energies studied and W varies from 2 to 7 Mev as the incident energy increases from 3.5 to 14.0 Mev. (auth)

6241

THE INDIRECT (p,d) PROCESS. Hitoshi Hagiwara (Hosei Univ., Tokyo) and Makoto Tanifuji (Univ. of Tokyo and Hosei Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 18, 97-100(1957) July.

In 300-Mev proton bombardment of various targets high-energy deuterons have been observed ejected at large angles where direct pick-up deuterons were improbable. For these deuterons, the dependence of the cross section on the mass number of the target nucleus suggests an indirect pick-up process, induced by secondary nucleons which are produced by one or more collisions of the primary proton in the same nucleus. With some assumptions about the pick-up probability of the secondary nucleons, the indirect process hypothesis is shown to give results consistent with the experimental data on energy spectrum shape and angular dependence of the deuterons. In the present note a calculation is made of the effective pick-up probability considering the attenuation effects of produced deuterons. (A.C.)

6242

INVESTIGATION OF THE REACTIONS $K^{39}(d,p)K^{40}$ AND $Ca^{40}(d,p)Ca^{41}$. I. B. Teplov and B. A. Yurev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1313-20(1957) Dec. (In Russian)

Nuclear emulsions were employed to study the angular distributions of three proton groups from the $K^{39}(d,p)K^{40}$ reaction for 4.0 Mev deuterons and also of the long range proton group from the $Ca^{40}(d,p)Ca^{41}$ reaction for 1.3, 2.2, and 4.0 Mev deuterons. The measured angular distributions do not agree with those computed from Butler's theory. Comparison of the results obtained for the two investigated reactions permits one to draw some conclusions regarding the lower states of the K^{40} nucleus. (tr-auth)

6243

FAST NEUTRON INDUCED DISINTEGRATION OF THE C^{12} NUCLEUS INTO THREE α-PARTICLES. S. S. Vasilev, V. V. Komarov, and A. M. Popova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1321-4(1957) Dec. (In Russian)

The energy dependence of the cross section for three α-particle disintegration of the C^{12} nucleus induced by fast neutrons is investigated from threshold energies up to 19 Mev. Information relating to variations in the mechanism of C^{12} disintegration into three α particles in the indicated primary neutron energy range is obtained on basis of calculations of the excitation energies of intermediate nuclei

involved in the disintegration and of the spatial and energy distributions of the disintegration products. (tr-auth)

6244
ELECTRODISINTEGRATION OF NUCLEI AT HIGH ENERGY. M. Ya Kobiashvili (Tiflis State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1505-6(1957) Dec. (In Russian)

6245
RELATIVE CROSS SECTIONS OF (n,p) AND (n,α) REACTIONS ON ELEMENTS WITH SEVERAL STABLE ISOTOPES. V. N. Levkovskii (Inst. of Chemical Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1520-1(1957) Dec. (In Russian)

The prevailing published data on (n,p), and (n,α) reactions using 14-Mev neutrons in general are not in complete agreement with the theoretical concepts of these processes. An attempt was made to evaluate the available published and experimental data and to establish an empirical law of n-p and n-α cross sections in relation to the basic characteristics of the nucleons. Measurements and corrections are given for the n-p cross section ratios of stable isotopes of Ca, Ti, Zn, Ge, Ga, Sr, Cd, and Ce, and for the n-α cross sections of four pairs of isotopes Ge^{72} : Ge^{77}, Ti^{46}:Ti^{47}, Zr^{94}:Zr^{96}, and Cd^{112}:Cd^{114}. It has been noted that n-p and n-α cross sections decreased with increase of isotopic mass number. New reactions were observed and new data were revealed for the radioactive isotopes from these reactions. (R.V.J.)

Particle Accelerators

6246 AERE-T/R-2361
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE RADIAL EQUATION FOR SPIRAL RIDGE ACCELERATORS. D. Morgan. Nov. 1957. 35p. $0.90(BSI).

A study is made of the equation $d^2\xi/d\phi^2 + \omega_1^2\,\xi = -\lambda \sin(\phi+\xi)$ which describes the radial betatron oscillations in a spiral ridged synchrotron, and certain deductions are made about the resulting forms of the phase diagrams. Forms of solution are given which apply respectively to the region between the "1/4" and "1/3" resonances, the region between $\omega_1 = 0$ and the "1/4" resonance, and the actual vicinities of these resonances. The first two forms of solution have been used elsewhere to interpret the results of digital computations. (auth)

6247 AERE-T/R-2423
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
VERTICAL MOTION IN SPIRAL-RIDGED ACCELERATORS. J. W. Burren. Dec. 1957. 20p. $0.63(BSI).

The mechanism limiting the growth of vertical oscillations for motion near non-linear coupled resonances in a spiral-ridged accelerator is studied. A method of calculation of the limiting ('turn-over') amplitude is given. The ultimate vertical stability of particles is also studied. (auth)

6248 INSJ-1
Tokyo Univ. Inst. for Nuclear Study.
DESIGN STUDY FOR THE INS 1-BEV ELECTRON SYNCHROTRON BY THE HIGH ENERGY DIVISION. Higoo Kumagai. June 13, 1957. 7p.

6249 UCRL-8022
California. Univ., Berkeley. Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. XIV. [Period covered] May, June, July 1957. Walter D. Hartsough. Oct. 24, 1957. 24p. Contract W-7405-eng-48. $0.75(OTS).

The first half of this quarter was in part a continuation of the shutdown of the last period and in part a shutdown recovery period. The second half of the quarter was devoted to high-energy physics and chemistry research and to the extension and improvement in techniques of producing secondary-particle beams. The principal physics research efforts were a continuation of the investigations of interactions of negative particles in hydrogen using the 10-inch liquid hydrogen bubble chamber; counter studies of the π^0 modes of heavy-meson and hyperon decay; and a series of twenty-one nuclear emulsion exposures to K-meson beams. During this period twenty emulsion stacks were exposed for thirteen external groups. Thirteen target bombardments were made for the chemistry group. (For preceding period see UCRL-8021.) (M.H.R.)

6250 AEC-tr-3163
THE PROTON SYNCHROTRON. C. J. Bakker. Translated from Ned. Tijdschr. Natuurk. 21, 201-9(1955). 15p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 10, as abstract No. 419.

6251
NONLINEAR EFFECTS IN ALTERNATING-GRADIENT SYNCHROTRONS. P. A. Sturrock (Stanford Univ., Calif.). Annals of Physics 3, 113-89(1958) Feb.

Nonlinear effects in alternating-gradient synchrotrons are responsible for resonances in the betatron-oscillation mechanism over and above those which arise in linear theory. These effects are here investigated by means of a perturbation procedure which leads directly to practical formulas. The larger part of the paper is given to "static" theory which ignores the acceleration process and concomitant synchrotron oscillation. Results are represented diagrammatically in three ways: by invariant contours in the phase plane; by "configuration diagrams" which are convenient transformations of the preceding diagrams; and by curves which relate the amplitudes of closed orbits to the characteristic phase. (auth)

6252
PHASE RELATIONSHIPS IN THE CYCLOTRON. N. D. Fedorov. J. Nuclear Energy 6, 255-7(1958).

An investigation has been made of the variation of the ion phases in a cyclotron during the first few turns. The investigation showed that ions leaving the region of the electric field during the first acceleration do not change phase significantly during subsequent accelerations. The remaining ions approach phase equilibrium by the end of the second half turn. (A.C.)

6253
ABOUT DAMPING AND ANTIDAMPING BETATRON OSCILLATIONS, TAKING INTO ACCOUNT NON-ADIABATIC PROPERTIES OF THE RADIATION. A. N. Matveev (State Univ., Moscow). Nuovo cimento (10) 6, 1296-1304(1957) Dec.

Radiation effects on operation of high energy electron synchrotrons are discussed. It is shown that there exist neither a damping nor an antidamping of betatron oscillations due to radiation. Accelerating cavities are taken into account with the aid of difference equations. The equation for betatron oscillations is presented taking account of the radiation and all kinds of accelerating fields. The life time of adiabatic invariants is calculated. (auth)

6254
ELECTRON MOTION IN SYNCHROTRONS IN THE PRESENCE OF RADIATION. A. N. Matveev (State Univ., Moscow). Nuovo cimento (10) 6, 1305-17(1957) Dec.

The effect of radiation fluctuations on electron motion in synchrotrons is discussed. A stochastic theory of betatron and phase oscillations, induced by radiation fluctuations, is presented. (auth)

6255

ON ELECTRON CAPTURE IN A BETATRON. V. A. Logunov and S. S. Semenov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1513-14(1957) Dec. (In Russian)

The process assisting electron capture in betatron accelerators was investigated. Assuming that the electrons in a given coordinate system are moving along the equilibrium orbit with azimuthal velocity of injected electrons then the meeting and collision of the electrons in such a set of coordinates is quite probable. The statistical conditions of sharp attenuation of oscillation may be fulfilled because of multiple scattering of some electrons injected on the equilibrium orbit. Evaluations were made of such phenomena. (R.V.J.)

Radiation Absorption and Scattering

6256 AERE-N/R-1165

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE INELASTIC SCATTERING OF COLD NEUTRONS BY CRYSTALS. II. EXPERIMENT. P. A. Egelstaff. 1957. Date of MS. Apr. 24, 1953. Decl. Nov. 7, 1956. 28p. $0.72(BIS).

The results verify the general picture given by the theory, and the values of the cross sections have been confirmed within reasonable limits. The anisotropy has been found to vary with incident neutron temperature and Debye temperature in the way theory predicts. The magnitude of the energy of the scattered neutrons and its dependence upon Debye temperature have been verified. An alternative way of expressing these results is to say that they confirm the Debye temperatures of Be, Mg, and Pb determined by other means. A feature of this part of the work is that it is probable for the energy gained by a cold neutron scattered by Be to be equivalent to raising its temperature to several times the crystal temperature. A similar effect was not found in Mg or Pb. (auth)

6257 NYO-7110

Carnegie Inst. of Tech., Pittsburgh.

POLARIZATION AND DEPOLARIZATION IN PROTON-PROTON COLLISIONS AT 415 MEV. Joseph A. Kane. June 1956. 83p. Contract AT(30-1)-882. $13.80(ph OTS); $4.80(mf OTS).

A 415-Mev, 53% polarized proton beam was obtained by an internal scattering in the Carnegie Institute of Technology synchrocyclotron. A second scattering by a liquid hydrogen target was performed externally to measure the polarization in elastic proton-proton scattering as a function of scattering angle. The maximum polarization thus observed was about 40%. The angular distribution of the polarized flux divided by $\sin\theta\cos\theta$ is fitted by an expression which is quadratic in $\cos^2\theta$, where θ is the center-of-mass angle. A triple scattering experiment was performed to determine the amount of depolarization occurring in elastic proton-proton scattering. The first scattering was the internal scattering which served as a polarizer to produce the polarized proton beam. The third scattering was from a carbon target and served as an analyzer for measuring the change in polarization produced by a second scattering from the liquid hydrogen target. Within a 20% experimental error the depolarization is isotropic in the center-of-mass angular range 50 to 90° with a magnitude of about 40%. (auth)

6258

SCATTERING AND POLARIZATION OF PROTONS BY NUCLEI. H. A. Bethe (Cornell Univ., Ithaca, N. Y.). Annals of Physics 3, 190-240(1958) Feb.

The relation of the polarized scattering of protons by complex nuclei to that by nucleons is investigated quantitatively. No model of nuclear forces is used, but the nucleon-nucleon scattering is directly represented by phase shifts. The agreement is found to be good for all the phase shift solutions which Stapp et al., have given for the proton-proton scattering, the deviation being from 0 to 25%. Thus the scattering by a complex nucleus can be obtained by superposition of the nucleon-nucleon scattering amplitudes. For the purpose of this comparison, the experimental data of Chamberlain et al., on the scattering and polarization of protons by carbon at small scattering angles are analyzed directly, i.e., the relevant scattering lengths are deduced from the experimental data, rather than the data synthesized from an assumed potential. The resulting nuclear absorption coefficient reproduces the observed inelastic scattering. The real part of the central potential is found to be attractive but very weak (about 4 Mev). The spin-orbit potential agrees with the nucleon-nucleon data and with some, but not all, previous theoretical values; it is only one-sixth of that required in the shell model. The analysis is facilitated by a theorem, first derived by Köhler and by Levintov, and that the polarization is given correctly by the Born approximation. Simple formulas are given to obtain the Born approximation scattering (and thus the potential) from the observed scattering. A particularly simple formula relates the Born approximation scattering to the nucleon-nucleon scattering. The expressions for the relevant amplitudes in nucleon-nucleon scattering are also simplified. It is further shown that the scattering matrix for nucleon-nucleon scattering at a given angle can be completely determined if all the standard triple scattering and polarization experiments are carried out. (auth)

6259

INELASTIC DIFFUSION IN IRON OF 14-Mev NEUTRONS. Jagadish Garg and Béchir Torki. Compt. rend. 246, 750-3 (1958) Feb. 3. (In French)

The spectrum of neutrons emitted by the inelastic diffusion of 14-Mev neutrons in iron has been measured by time-of-flight method. Groups of neutrons were found at about 1.3, 2.5, and over 3 Mev. (tr-auth)

6260

SCATTERING FUNCTIONS WITH CROSSING SYMMETRY AND THEIR APPLICATIONS TO THE PROBLEMS OF MESON-NUCLEON SCATTERING. Ning Hu (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 5, 1-10(1958) Jan.

It is shown that the general form of scattering functions satisfying appropriate crossing conditions are general solutions of the equations of Chew and Low. These scattering functions fall into two classes. In one class they are analytic functions (usually double valued) of the momentum variable k with only simple poles and zeros, while in the other class they have a line of discontinuity on the imaginary k-axis between $k = -i$ and $k = -i\infty$. (auth)

6261

K-SHELL IONIZATION BY PROTONS. S. Messelt (Univ. of Oslo, Blindern, Norway). Nuclear Phys. 5, 435-46(1958) Feb.

The thick target yield of K-shell x rays produced when protons of 0.14 to 1.3 Mev energy are stopped in Fe, Cu, Mo, Ag, Sn, and Ta has been measured with a NaI scintillation spectrometer. The corresponding cross sections for

K-shell ionization have been determined. The experimental values for the cross sections vary less with the atomic number and more with the energy than predicted by theory. An empirical formula, which reproduces with good approximation results reported here and by others, is given. (auth)

6262

ON THE MULTIPLE SCATTERING OF NEUTRONS IN HYDROGEN-LIKE SUBSTANCES. C. H. Blanchard (Pennsylvania State Univ., University Park). Nuclear Sci. and Eng. 3, 161-70(1958) Feb.

The spatial moments $\bar{r}^2$, $\bar{r}^4$, and $\bar{r}^6$ are calculated exactly for all energies below the source energy, for a point, isotropic source in an infinite, homogeneous medium in which there is no absorption and in which the scatterers scatter like hydrogen but with a $1/v$ cross section. For a monoenergetic source these moments are approximately consistent with a diffusion (Yukawa) radial distribution of the very low energy neutrons. Integration over a fission-like source spectrum, $\sqrt{E}\exp(-\alpha E)$, gives moments consistent with a radial distribution of the very low energy neutrons of the form of a first collision density, $r^{-2}\exp(-r/\lambda)$, but with a mean free path λ approximately twice the mean free path at the average source energy. The results are compared with those given by the first collision approximation. (auth)

6263

POLARIZATION EFFECTS IN BREMSSTRAHLUNG. G. Bŏbel (Istituto di Fisica Teorica dell'Università and Istituto Nazionale di Fisica Nucleare, Genoa). Nuovo cimento (10) 6, 1241-51(1957) Dec.

In pursuance of a method devised by Lipps and Tolhoek, the differential cross section of bremsstrahlung is written as a sum of eight terms, each correlating the different polarizations of the electron in the initial and final states and of the emitted photon. The formulas of Bethe and Heitler and of May, Gluckstern, and others are obtained as particular cases, and discussion is also carried on as to the emission of circularly polarized photons from electrons having longitudinal and transversal spin, respectively. (auth)

6264

DISPERSION RELATIONS FOR FERMIONS. Riazuddin (Fitzwilliam House, Cambridge, Eng.). Nuovo cimento (10) 6, 1252-67(1957) Dec.

Generalized dispersion relations for scattering of 2 fermions are derived in a way similar to that used for fermion-boson scattering. The 2-nucleon problem is discussed in particular. The relations are written for functions which can be expressed in terms of the phase shifts. (auth)

6265

SHAPE OF THE HIGH-ENERGY END OF THE ELECTRON-BREMSSTRAHLUNG SPECTRUM. E. G. Fuller, E. Hayward, and H. W. Koch (National Bureau of Standards, Washington). Phys. Rev. 109, 630-5(1958) Feb. 1.

The elastic scattering of photons by the 15.11-Mev level in C^{12} has been used to study with good energy resolution the number of photons at the high-energy end of a bremsstrahlung spectrum. The bremsstrahlung was produced by electrons accelerated in a betatron, the energy of which was varied in 35-kev increments. Targets were: a 0.025-inch-diameter tungsten wire and the following foils, 0.001- and 0.010-inch tungsten, 0.002-inch thorium and 0.010-inch nickel. The foils were used to study the dependence of the spectrum shape upon target thickness and atomic number. When compared with Bethe-Heitler spectra corrected for target thicknesses, the data indicate an excess number of photons in the tip of the spectrum. The experimental number depends on the atomic number of the target and cannot vary more rapidly than $Z^{\frac{1}{3}}$. (auth)

6266

POLARIZATION IN PROTON-PROTON SCATTERING AT 3 AND 4 MEV. M. H. Hull, Jr. and J. Shapiro (Yale Univ., New Haven, Conn.). Phys. Rev. 109, 846-50(1958) Feb. 1.

A phase-shift analysis of the proton-proton scattering data of Worthington, McGruer, and Findley has been carried out in an attempt to find fits which also lead to polarization of non-negligible size. Such fits, having P-wave phase shifts separated in spin-orbit order with first Born approximation spin-orbit splittings, have been found, giving a polarization as large as 4%. Phase shifts for $L \leq 2$ have been included, with those for higher values of L, J put equal to zero. (auth)

6267

SCATTERING OF FAST NEUTRONS FROM C^{12} AND F^{19}. J. E. Wills, Jr., J. K. Bair, H. O. Cohn, and H. B. Willard (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 891-7 (1958) Feb.

High-resolution total cross-section measurements were made in the vicinity of the neutron scattering resonance occurring in C^{12} at (2.076 ± 0.008)-Mev bombarding energy with a total width of 7 kev. These data, coupled with differential cross-section measurements in the same energy range, lead to the assignment of $D_{\frac{5}{2}}$ to this state in C^{13}. Angular distributions of neutrons scattered from C^{12} measured between 1.45 and 4.10 Mev were analyzed in terms of partial waves. The resulting phase shifts indicate that the $D_{\frac{5}{2}}$ state occurring at 2.95 Mev has a width of 90 kev, while the $D_{\frac{5}{2}}$ state at 3.67 Mev has a width of 1.69 Mev. Total cross-section measurements for fluorine, having resolutions of 20 and 70 kev, indicate the presence of resonances at 1.10 and 2.25 Mev, as well as some structure above 3 Mev not previously reported. Angular distributions were measured between 0.66 and 2.92 Mev. (auth)

6268

X-RAY AND ELECTRON SCATTERING BY MOLECULAR HYDROGEN. C. Carter, N. H. March, and D. Vincent (Atomic Energy Research Establishment, Harwell, Berks, and The University, Sheffield, Eng.). Proc. Phys. Soc. (London) 71, 2-16(1958) Jan.

A theoretical study has been made of the x-ray and electron scattering to be expected from molecular hydrogen. The methods of calculation have the common feature that they are based on expansions of the wave function, density and potential in Legendre polynomials. Simple self-consistent field wave functions, having spherical symmetry are presented and, while the binding energy thereby obtained is poor, it is found nevertheless that they may be utilized with success in both the x-ray and the electron scattering calculations. The x-ray scattering is also discussed on the basis of an LCAO molecular-orbital function and the 'floating' function of Gurnee and Magee. It is found that the results of the various approximations used agree well among themselves and also with experiment, and some conclusions regarding the charge distribution in the hydrogen molecule may be drawn. For the elastic scattering of slow electrons, it is found that there is good agreement between the present results and earlier work of Massey and Ridley if exchange is neglected in both cases. However, it is found that electron exchange markedly affects the scattering cross sections, thus confirming the essential conclusions of Massey and Ridley, although the method employed in the present work is probably not sufficiently reliable to enable the precise effect of exchange to be determined. (auth)

6269

THE ELASTIC SCATTERING OF POSITRONS BY ATOMS AND MOLECULES. H. S. W. Massey and A. H. A. Moussa (University Coll., London). Proc. Phys. Soc. (London) 71, 38-44(1958) Jan.

The information available concerning the cross sections for elastic scattering of slow positrons by helium, neon, argon, and hydrogen is analyzed in terms of collision theory. Evidence is found that the polarization of the neutral atom or molecule by the incident positron is important in these collisions. A variational calculation of scattering by atomic hydrogen does not support this conclusion. Further methods of investigating the problem are suggested. (auth)

6270

THE MEAN FREE PATH OF ALPHA PARTICLES IN NUCLEAR MATTER. B. A. Robson (Univ. of Melbourne). Proc. Phys. Soc. (London) 71, 126-8(1958) Jan.

The elastic scattering of α particles in the energy range 10 to 40 Mev has been treated theoretically in two different ways, a classified model and an optical model. As the results were conflicting and an incorrect term was used in the classical model calculation, the results were recalculated. According to the revised calculations, a reconciliation between the two models does not seem possible and the classical description of the path of α particles seems of doubtful validity. (J.S.R.)

6271

CRITICISM ON THE ASSUMPTIONS IN THE FORMAL SCATTERING THEORY. Tsutomu Imamura (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 18, 51-65(1957) July.

Radiation Effects

6272 ANL-5825

Argonne National Lab., Lemont, Ill.

IRRADIATION EFFECTS ON ZIRCONIUM-CLAD URANIUM-ZIRCONIUM FUEL PLATES. R. E. Bailey. Feb. 1958. 10p. Contract W-31-109-eng-38. $0.50(OTS).

This report summarizes the series of irradiations conducted in a Hanford reactor on specimens of zirconium-clad, uranium-zirconium fuel plates containing 3, 6, and 14 wt. % highly (93.4%) enriched uranium. More than thirty fuel plates were exposed during the test program, which extended over a period of several years. (auth)

6273 NP-6599

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON METALLO-ORGANIC COMPOUNDS AND ON POLYETHYLENE. Technical Memorandum No. 3. N. J. Broadway. Feb. 15, 1958. 6p. Project No. 2133. Contract AF33(616)-5171.

6274

RADIATION DAMAGE EXPERIMENTS AND THE NATURE OF THERMAL SPIKES IN III-V COMPOUNDS. Ulrich Gonser and Boudewijn Okkerse (Univ. of Illinois, Urbana). Phys. Rev. 109, 663-7(1958) Feb. 1.

Specimens of gallium antimonide were irradiated at liquid nitrogen temperature with 12-Mev deuterons. The results of resistivity measurements during irradiation and of x-ray observations after the irradiation suggest very strongly that thermal spikes are introduced under these conditions. In particular from the shape and the intensity of the x-ray reflections the conclusion is drawn, that in these spike regions the material is present in a liquid-like lattice configuration, markedly different from the matrix configuration. The observations on annealing support the suggested model. (auth)

6275

ELECTRICAL CONDUCTIVITY OF X-IRRADIATED NaCl. R. W. Christy and W. E. Harte (Dartmouth Coll., Hanover, N. H.). Phys. Rev. 109, 710-15(1958) Feb. 1.

The electrical resistance of Harshaw sodium chloride crystals exposed at room temperature to x-ray dose sufficient to produce about 6×10^{16} F centers/cm^3 has been measured as a function of time at constant temperatures between 150 and 200°C. The effects of previous heat treatment of the crystals, x-ray dose temperature of measurement, and preliminary optical bleaching have been observed. Initially the resistance of irradiated crystals is much greater than that of unirradiated ones. The resistance of the colored crystals at first decreases rapidly (for about 10 to 100 minutes, depending on the temperature). In the case of crystals used as received from Harshaw, the resistance even falls slightly below that of the normal uncolored crystals. Subsequently the resistance again increases, reaching a constant value (after about 50 to 1000 minutes) higher than for the normal crystal. If the crystals are optically bleached before the measurement the resistance increase recovers very much more slowly. The behavior can be restored to normal by annealing above 250°C. The slow resistance increase is seen as evidence for the production by the x-rays of excess positive-ion vacancies. (auth)

6276

EFFECT OF NEUTRON IRRADIATION ON INFRARED ABSORPTION IN SILICON. W. G. Spitzer and H. Y. Fan (Purdue Univ., Lafayette, Ind.). Phys. Rev. 109, 1011-12 (1958) Feb. 1.

It was observed that irradiation by fast neutrons or high-energy deuterons produces in silicon an absorption band with a peak of about 1.8 microns. A second effect observed was an apparent shift of the intrinsic absorption edge towards longer wave lengths. Both effects were found to be roughly proportional to the irradiation. (A.C.)

6277

LOW-TEMPERATURE IRRADIATION OF n-TYPE GERMANIUM. J. W. Cleland and J. H. Crawford, Jr. (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 29, 149-51 (1958) Feb.

The rate of change of conductivity of n-type single crystal plates of germanium at a temperature of ~ 16°K during fast neutron irradiation is enhanced over that previously observed at higher temperatures. Annealing studies subsequent to irradiation reveal no evidence of thermally unstable defect states between ~ 10 and ~ 95°K. Annealing above ~ 95°K indicates the presence of thermally unstable minority carrier traps of the type previously observed following irradiation at 120°K. The enhanced decrease in conductivity at 16°K compared to that observed at higher temperatures is believed to reflect a greater rate of introduction of defects, many of which anneal at temperatures above ~ 95°K. (auth)

6278

FADING OF COLORATION OF IRRADIATED GLASS. Sohei Kondo (National Inst. of Genetics, Misima, Japan). J. Phys. Soc. Japan 13, 224(1958) Feb.

Previous investigators have shown that the fading of coloration of gamma-irradiated phosphate glass can be represented by the formula $\mu(t) = Kt^{-0.067}$, where $\mu(t)$ is the change in absorption coefficient of glass measured at t hours after short exposures and K is a constant of proportionality. A similar relation was found to hold for fading of coloration of ordinary window glass irradiated by Co^{60} gamma rays. The formula $\mu(t) = Kt^{-\lambda}$, $\lambda = \exp(-A + BT)$, where A and B are constants dependent only on glass and wavelength and T denotes absolute temperature, gives very

good agreement with observed data over wide temperature ranges. Comparisons of experimental data and calculated results are shown. (A.C.)

6279

THE EFFECT OF NEUTRON IRRADIATION ON THE MARTENSITE TRANSFORMATION. A. I. Zakharov and O. P. Maksimova (Central Research Inst. of Ferrous Metallurgy). Soviet Phys. (Doklady) 2, 283-6(1957) May-June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 661.

6280

RADIATION DAMAGE AND IRRADIATION HARDENING. A. Seeger (Max-Planck-Institut für Metallforschung and Institut für theoretische und angewandte Physik der Technischen Hochschule, Stuttgart). Z. Naturforsch. 13a, 54-5(1958) Jan. (In German)

Radioactivity

6281

BETA DISINTEGRATION INTERACTION ACCORDING TO ACTUAL DATA ON β-RECOIL NUCLEUS ANGULAR CORRELATION. Vinh Mau. Compt. rend. 245, 2256-9(1957) Dec. 16. (In French)

An examination was made to determine if the actual contradictions between the data given by different experiments on the β-ν angular correlation could be cleared up by admitting errors a little larger than those given by different authors. The different agreements possible for the Fermi and Gamow-Teller interactions are given. (tr-auth)

6282

ON THE RELATIVE INTENSITY OF Po^{210} γ QUANTA. V. V. Ovechkin. Izvest. Akad. Nauk S.S.S.R. 21, No. 12, 1641-2(1957) Dec. (In Russian)

Relative intensities of 308-kev γ quanta emitted at the initial excitation level of Pb^{206} in Po^{210} α decay were experimentally evaluated and compared with previous data. (R.V.J.)

6283

DIRECTIONAL CORRELATION OF THE GAMMA RAYS OF Se^{76}. E. G. Funk, Jr. and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 109, 922-5(1958) Feb. 1.

Directional correlation measurements have been made on the 0.65 Mev–0.55 Mev, 2.05 Mev–0.55 Mev, and 1.40 Mev–1.20 Mev gamma-ray cascades in Se^{76} following the beta decay of 26.8-hr As^{76}. The energy levels of Se^{76} were found to have spins 0+, 2+, 2+, and 3+ in order of increasing energy. The 0.55- and 1.20-Mev gamma rays are pure electric quadrupole; the 0.65-Mev gamma ray almost pure electric quadrupole (<1% dipole); the 1.40-Mev gamma ray pure magnetic dipole; and the 2.05-Mev gamma ray a mixture of 95% electric quadrupole and 5% magnetic dipole. A possible explanation of the decay scheme in terms of vibrational levels is presented. (auth)

6284

A FOUR-STATE THEORY OF THE NEUTRINO. P. E. Cavanagh, C. F. Coleman, B. W. Ridley, and J. F. Turner (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 11-16(1958) Jan.

A scheme of coupling constants for the beta-decay interaction is proposed to explain a wide range of experimental results. The scheme assumes a four-state neutrino. It implies that all electron polarization measurements will yield one or the other of the values $\pm\nu/c$, whatever the values of the ratios C_T/C_A and C_s/C_v. (auth)

6285

ANGULAR DISTRIBUTION AND LINEAR POLARIZATION OF THE GAMMA RAYS FROM ORIENTED ^{56}Co NUCLEI. A. N. Diddens (Natuurkundig Laboratorium, Rijksuniversiteit, Groningen, Netherlands) and W. J. Huiskamp, J. C. Severiens, A. R. Miedema, and M. J. Steenland (Kamerlingh Onnes Laboratorium, Leiden). Nuclear Phys. 5, 58-88(1958) Jan.

Measurements are reported on the beta-gamma and gamma-gamma coincident radiation observed in the decay of Co^{56} and on the angular distribution and linear polarization of the gamma rays emitted by oriented Co^{56} nuclei. Discrepancies between various proposed decay schemes have been removed by means of coincidence measurements (performed at room temperature). Experiments with oriented nuclei (using low temperature techniques) gave information about the multipole order of the gamma rays, the mixing ratio of two multipoles and the electric or magnetic character of the transitions. As a result, evidence is presented for a decay scheme of Co^{56} and for spin and parity assignments to the excited levels in Fe^{56}. A possible theoretical interpretation of some of these levels is discussed. A review is given of the data available from other experiments. (auth)

6286

BETA AND GAMMA RAY SPECTROSCOPY OF Cs^{137}. Yasukazu Yoshizawa (Osaka Univ.). Nuclear Phys. 5, 122-40(1958) Jan.

Beta rays and internal conversion electrons from Cs^{137} have been studied using a two directional focusing beta ray spectrometer (ϱ = 40 cm). The K shell conversion coefficient α_K of 661 kev gamma transition has been determined to be 0.0976 ± 0.0055, and K/L/M to be (5.66 ± 0.04)/1/(0.260 ± 0.003), which are in good agreement with Rose's calculated values for the M4 transition. The maximum energy of the lower component of the beta rays has been found to be 514 ± 2 kev. The Kurie plot, corrected by the factor of the unique first forbidden transition, shows a straight line. The spectrum of the higher component was interpreted by the second forbidden correction factor with a linear combination of scalar and tensor interactions. In an attempt to determine the sign of the ratio of scalar to tensor interaction constants, G_S/G_T, the spectrum could be only explained by the negative sign, assuming that the single particle model is a good approximation for the nuclear matrix elements. (auth)

6287

MANY BODY EFFECTS IN BETA-DECAY. J. S. Bell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 167-72(1958) Jan.

In mirror transitions involving nuclei with doubly closed cores plus or minus one particle the Gamow-Teller contribution appears to be smaller, by from 15% to 60%, than that predicted by the shell model. The effect of correlation in the nuclear wave function, tentatively estimated by applying perturbation theory to a simple Fermi gas model, is found to be in the right direction but too small. (auth)

6288

GAMMA RADIATION FROM ^{141}Nd. H. L. Polak, W. Schoo, B. L. Schram, R. K. Girgis, and R. van Lieshout (Inst. for Nuclear Physics Research, Amsterdam). Nuclear Phys. 5, 271-3(1958) Jan.

A scintillation spectrometer study of the disintegration of Nd^{141}, produced by a (d, 2n) reaction on Pr^{141}, shows that it decays mainly by electron capture, accompanied by a weak positron group (1.9%); two weak gamma rays with energies of 1.14 Mev (0.50%) and 1.30 Mev (0.26%) have

been found. The results are given. A decay scheme is proposed. (auth)

6289

ON THE DECAY OF ^{113}Sn AND ^{121}Te. K. S. Bhatki, R. K. Gupta, S. Jha, and B. K. Madan (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 6, 1461-8(1957) Dec.

By coincidence studies of Sn^{113} and by studying Sn^{113} sources completely separated from In^{113}, the existence of a level at 650 kev in In^{113} resulting in the emission of 258 kev γ ray has been established. This state is fed by the electron capture transition in Sn^{113} to the extent of about 3.5%. The decay energy of Sn^{113} leading to the 650 kev state has been calculated to be 36 kev. In the decay of Te^{121m} and Te^{121} γ rays of energy 70 kev and 1,130 kev have been observed. (auth)

6290

COUPLING CONSTANT INVARIANTS IN β-DECAY. S. Kahana and D. L. Pursey (Univ. of Edinburgh). Nuovo cimento (10) 6, 1469-79(1957) Dec.

The principle recently used by Pauli and Pursey is extended and applied to single β decay without lepton conservation, and to β decay with nonvanishing neutrino mass. Identities are found between the coupling constant invariants for Pauli's general interaction, and it is shown that these involve at most 35 independent real constants. Conditions are given for invariance under space inversion, time reversal, particle-antiparticle conjugation, and for four interesting special theories, including lepton conservation and the two-state neutrino theory. A brief discussion is given of how experimental knowledge of the invariants, in particular those occurring in single β decay, can be used to check the various special cases. (auth)

6291

POSITRON DECAY OF Cu^{59} AND Cu^{61} AND ENERGY LEVELS IN Ni^{59} AND Ni^{61}. J. W. Butler and C. R. Gossett (U. S. Naval Research Lab., Washington). Phys. Rev. 109, 863-71(1958) Feb. 1.

The energies and relative intensities of the gamma rays following the positron decay of Cu^{59} have been determined. The energies are 0.343 ± 0.004, 0.463 ± 0.010, 0.872 ± 0.005, 1.305 ± 0.005, and 1.70 ± 0.01 Mev, with respective relative intensities of 16 ± 3, 15 ± 5, 29 ± 4, 36 ± 4, and 4 ± 2%. The half life of Cu^{59} was measured to be 81.5 ± 0.5 seconds. The energies of ground-state transition gamma rays following the positron decay of Cu^{61} were measured as 0.070 ± 0.002, 0.282 ± 0.003, 0.659 ± 0.003, and 1.192 ± 0.005 Mev. The accumulated works of several authors are discussed and compared. (auth)

6292

INTERNAL CONVERSION COEFFICIENTS OF M1 GAMMA RAYS OF Au^{199} AND Au^{195}. Paul J. Cressman and Roger G. Wilkinson (Indiana Univ., Bloomington). Phys. Rev. 109, 872-8(1958) Feb. 1.

An attempt has been made to measure the internal conversion coefficients of the M1 + E2 radiations of Au^{199} and Au^{195} with sufficient accuracy to check the effect of the finite nuclear size on internal conversion in this region of Z. In the case of Au^{199} a direct comparison of the 158-kev pure E2 transition with the 208-kev M1 + E2 radiation was possible. Comparison of the gamma-ray intensities determined from scintillation spectrometry with conversion line intensities measured in a small shaped-field spectrometer yielded K, L, M, total shell coefficients. Comparison of these gamma-ray intensities with conversion line intensities photographically recorded in a higher resolution permanent-field spectrometer led to L-subshell coefficients. The results for the 208-kev transition are: $a_K = 0.71 \pm 0.05$, $a_L = 0.144 \pm 0.01$, $a_{LI} = 0.114 \pm 0.007$, $a_{LII} = 0.0227 \pm 0.0007$, $a_{LIII} = 0.0065 \pm 0.0005$, $a_M = 0.042 \pm 0.04$, and $a_{N+O} = 0.0083 \pm 0.001$. The empirical multiplicative factors f by which point-nucleus theoretical values are to be reduced, presumably due to the finite nuclear effect, and the E2 mixing ratio r have been determined: $f_K = 0.762 \pm 0.08$, $f_{LI} = 0.78 \pm 0.13$, $f_{LII} = 1.00 \pm 0.06$, $f_{LIII} = 1.0$, and $r = 0.11 \pm 0.03$. These results, insofar as they may be compared, are not inconsistent with Sliv's predictions ($f_K = 0.8$). An experimental value of 0.60 was found for the screening correction to Rose's M-shell coefficients for this Z and energy region. In the case of Au^{195} only permanent-field spectrograph measurements of the L- and M-subshell conversion of the 98-kev M1 + E2 transition were accurate enough for analysis. A comparison of the experimental ratios with the corresponding theoretical point-nucleus L and M values, the latter being corrected empirically for screening, gives: $f_{LI} = 0.82 \pm 0.10$, $f_{LII} = 0.73 \pm 0.20$, $r = 0.014 \pm 0.003$. In this analysis it has been assumed that L_{III} shell correction is negligible. More accurate energy values and branching ratios have been obtained. For the radiations of Au^{199} we find energies of 49.7, 158.3, and 208.0 kev with corresponding relative intensities 8%, 76%, and 16%. The Au^{195} energies and relative transition rates are 30.8, 98.5, and 129.4 kev, 20%, 72%, and 8%, respectively. Energy values are internally consistent to 0.10 kev. (auth)

6293

RADIOACTIVE DECAY OF Se^{83}. Robert G. Cochran and William W. Pratt (Pennsylvania State Univ., University Park) Phys. Rev. 109, 878-83(1958) Feb. 1.

An experimental investigation, using scintillation techniques, has been made of the gamma radiation emitted by the 69-second isomer of Se^{83}. The Se^{83} was produced by irradiating selenium, enriched in the isotope Se^{82}, in the reactor neutron flux. Gamma rays of energy 2.02 ± 0.05 Mev, 1.10 ± 0.02 Mev, 0.650 ± 0.005 Mev, and 0.350 ± 0.006 Mev were found, each with a (70 ± 1)-second half life. Of these, only the 0.350-Mev gamma ray was found in the 25-minute isomer. From these measurements, together with beta-gamma and gamma-gamma coincidence measurements and a rough beta-ray end-point determination, a decay scheme is proposed for the 69-second isomer of Se^{83}. (auth)

6294

RADIOACTIVITY ON In^{120} AND Sb^{120}. Carl L. McGinnis (National Bureau of Standards and National Research Council, Washington). Phys. Rev. 109, 888-90(1958) Feb. 1.

An investigation of the radiations from the mass-120 isobars has been made using magnetic lens, scintillation pulse-height, and coincidence counting techniques. Sb^{120m} decays with a 5.8-day half life by electron capture, positron emission if any < 0.03%, to an 11-μsec level of Sn^{120} which then decays by the emission of the following gamma rays (energies in Mev): 0.089 (E1), 0.199 (E2), 1.04 (E2), and 1.18 (E2). The 1.18-Mev gamma ray also occurs in the decay of the 16-min Sb^{120}, where the number of gamma rays per positron is 0.03. An activity of ~ 55 sec is assigned to In^{120m}. A decay scheme is proposed. (auth)

6295

FIERZ INTERFERENCE OF THE FERMI INTERACTIONS IN BETA DECAY. J. B. Gerhart (Univ. of Washington, Seattle). Phys. Rev. 109, 897-900(1958) Feb. 1.

The coupling constant combinations ($|C_S|^2 + |C_S'|^2 + |C_V|^2 + |C_V'|^2$) and $Re(C_S C_V^* + C_S' C_V'^*)$ are evaluated for the beta-decay interaction by an analysis of data for $0 \rightarrow 0$ (no) transitions. (auth)

6296

YIELDS, ANGULAR DISTRIBUTIONS, AND POLARIZATION OF GAMMA RAYS FROM COULOMB EXCITATION.

F. K. McGowan and P. H. Stelson (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 901-16(1958) Feb. 1.

The yields of gamma rays resulting from Coulomb excitation have been measured for Tl^{205}, Tl^{203}, Au^{197}, Ir^{193}, Ir^{191}, Re^{187}, Re^{185}, W^{183}, Ta^{181}, Cd^{112}, Cd^{111}, Ag^{109}, Ag^{107}, Rh^{103}, Mo^{95}, Os^{192}, Os^{190}, Os^{188}, W^{186}, W^{184}, and W^{182}. Angular distributions of the gamma radiation from the nuclei Tl^{205}, Tl^{203}, Au^{197}, Ir^{193}, Ir^{191}, Re^{187}, Re^{185}, Ta^{181}, Cd^{111}, Ag^{109}, Ag^{107}, Rh^{103}, and Mo^{95} have been measured with respect to the incident proton beam on thick targets. The linear polarization of gamma rays following Coulomb excitation has been studied. A polarimeter based on the Compton scattering mechanism has been constructed and its effectiveness determined by measurements of the known polarization of gamma rays from excitation of 2+ levels in even-even nuclei. Polarization-direction measurements of several transitions in odd-mass nuclei have resolved the ambiguity either in the value of $(E2/M1)^{\frac{1}{2}}$ or in the spin of the excited state deduced from the angular distributions. Reduced transition probabilities for E2 and M1 transitions are obtained. In some instances these quantities are compared to the predictions of the collected model of the nucleus. (auth)

6297

DIRECTIONAL CORRELATIONS OF GAMMA RAYS IN Te^{124}. Takeo Hayashi (Saikyo Univ., Kyoto). J. Phys. Soc. Japan 13, 117-25(1958) Feb.

The directional correlations of the 2.11 to 0.605 Mev and 1.71 to 0.605 Mev gamma-gamma cascades in Te^{124} have been measured by using a coincidence spectrometer newly designed. Both of the correlation functions are compatible with the sequence 3 (D, Q) 2 (Q) 0, where quadrupole admixture in the first radiation is expected to be very small. The false coincidences occurring in this type of circuit are also described in some details. (auth)

6298

HELICITY OF NEUTRINOS. M. Goldhaber, L. Grodzins, and A. W. Sunyar (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1015-17(1958) Feb. 1.

A combined analysis of circular polarization and resonant scattering of γ rays following orbital electron capture measures the helicity of the neutrino. A measurement was carried out with Eu^{152} which decays by orbital electron capture. Assuming the most plausible spin-parity for this isomer compatible with its decay scheme, 0-1, it was found that the neutrino was "left handed," and had negative helicity. (A.C.)

6299

INTERFERENCE BETWEEN GAMOW-TELLER AND FERMI INTERACTION IN Mn^{52}. F. Boehm (California Inst. of Tech., Pasadena). Phys. Rev. 109, 1018-19(1958) Feb. 1.

The note describes the result of studies of the interference term in the beta decay of Mn^{52}. (A.C.)

6300

LIFETIME OF A 1^- LEVEL IN Sm^{152}. L. Grodzins (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1014-15(1958) Feb. 1.

6301

NUCLEAR GAMMA RAY RESONANCE IN ^{48}Ti. V. Knapp (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 71, 194-200(1958) Feb.

The resonance scattering of the V^{48} 900-kev gamma rays in titanium was observed using the recoil of the previous transition to restore the recoil losses. From the measured scattering cross section, the mean life of the 990-kev level was found to be $(6 \pm 2) \times 10^{-12}$ sec, which is rather shorter than the Coulomb excitation value. Extending the comparison of mean lives as obtained by the two methods to other even-even nuclei, the same discrepancy is found in all available cases. (auth)

6302

ANGULAR CORRELATIONS OF GAMMA RAYS IN ^{103}Rh. F. C. Flack and P. Mason (Univ. of Exeter, Eng.). Proc. Phys. Soc. (London) 71, 247-51(1958) Feb.

Lifetime measurements indicate that the 55 kev transition in Rh^{103} is mostly dipole in character. Angular correlation measurements involving this transition rule out $\frac{5}{2}^+$ for the spin of the level at 538 kev, but allow $\frac{7}{2}^+$ or $\frac{9}{2}^+$, the former being preferred. The spin of the 650 kev level is not determined by these results. (auth)

6303

A POSSIBLE CHECK OF THE "COMBINED PARITY" CONSERVATION FOR BETA INTERACTION. A. Z. Dolginov (Leningrad Inst. of Technical Physics). Zhur. Eksptl'. i Teoret. Fiz. 33, 1363-70(1957) Dec. (In Russian)

To elucidate the problem concerning the invariance of β interaction with respect to time inversion, it is proposed to observe β-γ angular correlation in allowed transitions in aligned nuclei. Formulas have been obtained for a β-γ correlation for nuclei orientated by different methods. The analysis is carried out for the general type of β interaction with account taken of the nonconservation of parity. An expression is given for β-γ angular and polarization correlation for orientated nuclei in the case of β transitions of any order of forbiddenness. (tr-auth)

6304

ANGULAR DISTRIBUTION AND POLARIZATION OF ELECTRONS EMITTED IN THE β-DECAY OF ALIGNED NUCLEI. I. M. Shmushkevich (Leningrad Inst. of Technical Physics). Zhur. Eksptl'. i Teoret. Fiz. 33, 1477-82(1957) Dec. (In Russian)

The angular distributions and polarization of electrons (positrons) emitted in β decay of aligned nuclei are calculated for allowed transitions with account of parity nonconservation. (tr-auth)

Rare Earths and Rare-earth Compounds

6305 IDO-16333

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EXPERIENCE WITH THULIUM RADIOGRAPHY AT THE MTR. S. D. Reeder. Oct. 25, 1957. 39p. Contract AT(10-1)-205. $1.00(OTS).

A program was undertaken at the MTR to obtain information related to the production and use of Tm^{170} for radiographic purposes. Several pellets of Tm metal were irradiated for different lengths of time and the activity of each source was measured in a reproducible manner. The activity produced as a function of irradiation time indicated that the production of Tm^{170} is not seriously inhibited by its own neutron capture. A portable camera was designed to make practical use of the Tm sources for radiographic purposes at the NRTS. Exposure parameters were determined for several materials and the radiographic quality obtained with Tm criticized from experience obtained in its use. (auth)

6306

EXCITED STATES OF Eu^{153}. C. W. McCutchen (Cavendish Lab., Cambridge, Eng.). Nuclear Phys. 5, 187-94(1958) Jan.

The β^- decay of Sm^{153} and the electron capture decay of Gd^{153} have been studied with a NaI scintillation spectrometer, with a xenon proportional counter used with and without escape gating, and with a conversion-electron proportional counter. The two decay schemes have been verified and, in one case, extended. From a measurement of its

internal conversion coefficient the 97 kev γ in the Gd^{153} decay is shown to be E1. The decay schemes and multipolarities are shown to be inconsistent with any likely spin sequence for Eu^{153} and ground state spin of Gd^{153}. (auth)

6307

A NOTE ON THE ISOTOPIC ASSIGNMENT OF SLOW NEUTRON RESONANCES IN SAMARIUM, IRIDIUM AND GADOLINIUM. E. M. Bowey and J. R. Bird (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 294-6(1958) Jan.

Some further isotopic assignments of slow neutron resonances have been made with the elements samarium, iridium, and gadolinium, using the Harwell 15 Mev linear accelerator and capture gamma ray scintillation detectors. (auth)

Shielding

6308 HW-53395

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NEUTRON ATTENUATION OF MAGNETITE CONCRETE HEATED TO 100 C. D. E. Wood. Oct. 29, 1957. Decl. Feb. 25, 1958. 13p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Neutron attenuation of Magnetite concrete heated to 100°C was measured in the DR shield test well. Gold and S foil detectors were used to determine fast, epithermal, and thermal fluxes at intervals through 48 in. of concrete. The fast neutron relaxation length is 9.52 cm, compared to 8.75 cm for the unheated concrete, a 9% increase as a result of this heating. Thermal and epithermal attenuation curves show little indication that water loss has been sufficient to significantly change intermediate energy neutron leakage. Side to side traverses indicate the possibility that streaming up the edges of the well is affecting the measurements near the outside of the well. This does not affect the fast neutron relaxation length which is determined in the first 32 in. of concrete. However, the thermal and epithermal traverses would normally be used to confirm the relaxation length in the outer part of the well where spectral equilibrium should be established. This procedure is not valid if serious streaming is present. (auth)

6309 HW-54656

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ATTENUATION PROPERTIES OF HIGH DENSITY PORTLAND CEMENT CONCRETES AS A FUNCTION OF TEMPERATURE. W. L. Bunch. Jan. 22, 1958. 55p. Contract W-31-109-Eng-52. $1.50(OTS).

The elevated temperatures used in the test appreciably impaired the neutron and gamma attenuation properties of the two high density concretes. Nonetheless, the concretes would serve as satisfactory shield material if the reduced attenuation efficiency at the elevated temperatures were taken into account in the original reactor design. The two concretes used in the test were: (1) iron limonite, which consists of an aggregate of iron punchings and a grout of limonite, and iron ore containing water of hydration, and (2) magnetite limonite in which the non-hydrated iron ore magnetite is used as an aggregate and the limonite again is the grout material. Significant changes in attenuation effectiveness were found as the concretes were heated to 100 and 175°C, but very little change was effected in the final heating to 320°C. The density of the concretes was similarly affected, indicating that the bulk of the water had been evolved at 175°C and that the water which remained was more tightly bound. Because of this apparent saturation effect it should be possible to extrapolate the attenuation properties to slightly higher temperatures than those used if future laboratory tests were to show that no significant change in density and water content took place at the proposed temperature. (auth)

6310

CONCRETE IN RADIATION PROTECTION TECHNIQUES. Thomas Jaeger. Atomkern-Energie 3, 69-72(1958) Feb. (In German)

6311

COEFFICIENTS OF LINEAR ABSORPTION OF FAST NEUTRONS IN CONCRETE. Marcos Mazari, Fernando Alba, Manuel Vásquez Barete, Luis Velázques, Juan Velázquez, and Ignacio Castro (Instituto de Física de la Universidad Nacional Autónoma de México). Rev. mex. fís. 6, 1-8 (1957). (In Spanish)

Coefficients of linear absorption in samples of concrete, clay, and plaster were determined. In a series of 12 samples of concrete fabricated with normal and rapid setting cement, employing andesitic aggregates, Σ was observed to diminish with density and increase with neutron energy. The Σ's vary from 0.085 to 0.097 cm for densities ρ ranging from 2080 to 2190 kgm^{-3}, using neutron energies of 13.0, 14.5, and 16.2 Mev. Determinations in a concrete slab 1m × 1m × 10.1 cm yield Σ values of the order of 5% with respect to a cylindrical tube of the same dosage. In a dry clay of Guaymas, and in common plaster, the linear absorption coefficients in the same energy range give results of 0.069 and 0.071 cm^{-1}, respectively. This information should be useful in the design of walls for protection against fast neutrons using concretes common in Mexico. (tr-auth)

Spectroscopy

6312

OPTICAL DETECTION OF ZERO-FIELD HYPERFINE SPLITTING OF Na^{23}. M. Arditi (Federal Telecommunication Laboratories, Nutley, N. J.) and T. R. Carver (Princeton Univ., N. J.). Phys. Rev. 109, 1012-13(1958) Feb. 1.

6313

NOTE ON THE Li II SPECTRUM. G. W. Series and K. Willis (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 71, 274(1958) Feb.

A line was observed in the Li II spectrum at 8517.1 ± 1.5 A which was identified with the transition $1s2p\ ^1P_1-1s2s\ ^1S0$. The line at 8517A appeared only when other lines of the Li II spectrum were present. (A.C.)

6314

MAGNETIC SPECTROGRAPH FOR THE STUDY OF NUCLEAR REACTIONS. Marcos Mazari, Ignacio Castro, Fernando Alba, and Mario Vazqueq R. (Laboratorie Van de Graaff del Instituto de Física Universidad Nacional Autónoma de Mexico). Rev. mex. fis. 6, 9-60(1957). (In Spanish)

A broad-range magnetic spectrograph, similar to the one built by the High Voltage Laboratory Group of the Massachusetts Institute of Technology, was designed and built to be used for nuclear reaction studies of the light nuclei with the 2 Mev, Van de Graaff machine of the National University of Mexico. Some useful changes were made such as a new design of the vacuum chamber and of the power supply for the stabilization system for the magnet. In the last runs the vacuum in the system as a whole has been of the order 2×10^{-5} mm Hg. The electronic stabilization system and the nuclear magnetic fluxmeter were put into operation

with stabilities of the order of (1/8000). The photographic camera was focused and an accurate calibration was carried on using monoenergetic α particles from a Po^{210} standard source. Optic characteristics and limitations of the spectrograph are discussed in detail, as well as the equations including relativistic corrections to be used in the calculation of nuclear reactions where particles are involved. The Van de Graaff machine was improved by means of a strong focusing electrostatic lens placed between the deflecting magnet and the target chamber, in order to avoid elastic scattering that produces a high background in the spectra when slits or diaphragms are used. As examples of the accuracy in the studies that can be carried out with the new instrument, a $O^{16}(d,p)O^{17}$ reaction was studied in order to determine whether the first excited state of O^{17} was a doublet or a singlet. The oxygen reaction and elastic scattering on C^{12} and Au^{197} were used to calibrate the radius of curvature of the deflecting magnet. Due to the cross section studies that the laboratory is carrying on using fast neutrons and to the general interest in knowing the accurate Q value of the reaction T(d,α)n, exposures at 90, 80 and 60° with respect the direction of a beam hitting a tritium target, were done bombarding it with 0.63 Mev deuterons. The mean Q value obtained including relativistic corrections is 17.580 ± 0.025 Mev. The outstanding characteristics of this spectrograph are the high resolution energy range (2.74) covered simultaneously in an exposure and the possibility of rotating the spectrograph from 0 to 130° with respect to the beam direction. (auth)

Theoretical Physics

6315

STUDY OF TENSOR FIELDS WITHOUT SUPPLEMENTARY CONDITIONS. Tzou Kuo-Hsien. Ann. phys. 2, 776-826 (1957) Nov.-Dec.

In the present study the multitemporal formalism of the field theory is used. By the use of these covariant formulas a general and complete study of the decomposition of the spin states of the tensor fields without supplementary conditions is obtained. The investigation includes the vector and pseudovector field reacting with a spinor field, quantizing in the space of moments, significance of the separation of the spin states, electromagnetic reactions, tensor fields of the second order, and tensor fields of any order. (J.S.R.)

6316

THE RANGE-THICKNESS RELATION IN THE PROBLEM OF THE DEUTERON. Philippe Pluvinage and Joseph Proriol. Compt. rend. 245, 2201-3(1957) Dec. 16. (In French)

6317

CERTAIN PECULIARITIES OF SOLUTIONS OF THE EQUATION OF CHEW AND LOW. Marcel Froissart and Roland Omnès. Compt. rend. 245, 2203-6(1957) Dec. 16. (In French)

The analytical peculiarities of solutions of the Chew and Low equations are studied in the static case of symmetric pseudoscalar mesons. In particular, the Riemann surface of these functions is determined completely and it is shown that the surface permits an infinite number of layers. (tr-auth)

6318

NEW CLASSIFICATION OF ELEMENTARY PARTICLES CONCEIVED AS STABLE AND EXCITED STATES OF RELATIVISTIC FLUID MASSES IN ROTATION. Pierre Hillion, Georges Lochak, and Jean-Pierre Vigier. Compt. rend. 246, 896-9(1958) Feb. 10. (In French)

By means of six quantum numbers introduced in the primary integrals of the movement of relativistic particles, a new classification of particles is established which includes the leptons and photons. (tr-auth)

6319

THE INTERACTION BETWEEN A MOLECULAR GAS AND RADIATION. Paul N. Roussopoulos. Compt. rend. 246, 899-901(1958) Feb. 10. (In French)

The total Hamiltonian of the interaction between a molecular gas and radiation is derived, and the longitudinal waves are eliminated as in the common scheme of quantum electrodynamics. In the elimination of the longitudinal waves a Coulomb interaction term is introduced for the dipole electric moments. (J.S.R.)

6320

APPLICATION OF THE TAMM-DANCOFF METHOD TO THE LEE-MODEL. W. Heisenberg (Max-Planck-Inst. für Physik, Göttingen, Germany). Nuclear Phys. 5, 195-201(1958) Jan.

The new Tamm-Dancoff-method is applied to the Lee-model, after the renormalization for the special case of the 'dipole-ghost' had been carried out. The Tamm-Dancoff method leads to the exact solutions. Contravariant representations of the state vectors by means of the renormalized operators can be found only if these operators are spread out over finite time intervals, i.e., if integrals of the operators over finite time intervals are applied to the state vector of the vacuum. (auth)

6321

A THEORETICAL BASIS FOR A POSSIBLE THEORY OF β DECAY. J. C. Polkinghorne (Univ. of Edinburgh). Nuclear Phys. 5, 288-93(1958) Jan.

A theoretical basis is proposed for a β-decay interaction similar to that suggested by Arnowitt and Feldman. The theory would account for a zero mass neutrino (though it is not a two-component theory) and negatron emission through S and T together with positron emission through A and V. It is based on a possible theory of the source of the masses of the elementary particles. An explanation is offered of the anomalous muon mass. (auth)

6322

DISPERSION RELATIONS FOR WEAK INTERACTIONS. N. N. Bogolubov, S. M. Bilenky, and A. A. Logunov (Lab. of Theoretical Physics, Dubna, USSR). Nuclear Phys. 5, 383-9(1958) Jan. (2).

Dispersion relations for weak interaction processes are obtained in the present paper. It is shown that in processes which involve not only weakly interacting but strongly interacting particles as well, the dispersion relations are equivalent to the statement that the unknown amplitude functions, which are determined by strong interactions, depend only on momentum transfer between strongly interacting particles. (auth)

6323

DAMPING THEORY STUDY OF ELASTIC SCATTERING OF DIRAC PARTICLES WITH ACCOUNT OF POLARIZATION EFFECTS. A. A. Sokolov, B. K. Kerimov, and I. I. Guseinov (Moscow State Univ.). Nuclear Phys. 5, 390-400 (1958) Jan. (2).

Elastic scattering of Dirac particles by a short-range force center is considered from the standpoint of radiation damping theory. The expression for the scattering amplitude is determined. The integral equation thus obtained for the scattering amplitude permits one to investigate polarization effects. (auth)

6324

PARITY NON-CONSERVATION AND TRANSVERSE POLARIZATION OF β-PARTICLES. G. Györgyi and H.

Überall (Ecole d'Été de Physique Théorique, Les Houches, Haute Savoie, France). Nuclear Phys. 5, 405-8(1958) Jan. (2)

The electron polarization with given electron and neutrino momenta is calculated using the general parity non-conserving Hamiltonian of Lee and Yang. (J.S.R.)

6325

ON SYMMETRIES OF WEAK INTERACTIONS. B. D'Espagnat and J. Prentki (CERN, Geneva) and Abdus Salam (Imperial Coll. of Science and Tech., London). Nuclear Phys. 5, 447-54(1958) Feb.

The $|\Delta I| = \frac{1}{2}$ rule is replaced by a conservation law. This new scheme is practically equivalent to the rule just mentioned (with the possibility of introducing in a natural way some $|\Delta I| = \frac{3}{2}$ admixture). Its main advantage is that it can incorporate lepton interactions. (auth)

6326

β-DECAY AND NON-CONSERVATION OF PARITY. V. B. Berestetsky, B. L. Ioffe, A. P. Rudik, and K. A. Ter-Martirosyan (USSR Academy of Sciences, Moscow). Nuclear Phys. 5, 464-94(1958) Feb.

Effects due to nonconservation of parity such as longitudinal and transverse polarization of β electrons, angular distribution of β electrons from an oriented nucleus (including the case when the direction of the recoil nucleus momentum is fixed) are examined in the present paper for the cases of allowed β transitions and first order forbidden transitions. It is shown that owing to the influence of the Coulomb field the magnitude of these effects for forbidden transitions in heavy and intermediate nuclei is the same as for allowed transitions. Perceptible deviations are observed in light nuclei ($Z \lesssim 20$). In the particular case of a $0-0$ transition comparison with experiment may yield important data on the contribution of pseudoscalar coupling. Unique transitions ($\Delta j = 2$, yes) for which the electron angular distribution of oriented nuclei essentially differs from that for allowed transitions are considered separately. (auth)

6327

THE ANALYSIS OF ANGULAR AND DIRECTION-POLARIZATION CORRELATION MEASUREMENTS ON MIXED TRANSITIONS. C. F. Coleman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 495-503(1958) Feb.

When two experimentally observed quantities a_{exp}, b_{exp} are given theoretically as known functions a(t), b(t) of a continuous variable t, a comparison between the experimental results and the theoretical predictions can be made by plotting the curve $x = a(t)$, $y = b(t)$, and noting whether the point $x = a_{exp}$, $y = b_{exp}$ lies on it. This allows a very direct comparison of the measured values of the angular correlation parameters A_2, A_4 with the theoretical predictions for any spin sequence involving a single mixed transition. Comparison between numbers of experimental and theoretical results on a single graph becomes possible, and the technique can also be used for direction-polarization correlations involving a single mixed transition. (auth)

6328

ON THE CONSERVATION OF THE LEPTON NUMBER. Michiji Konuma (Univ. of Tokyo). Nuclear Phys. 5, 504-11 (1958) Feb.

The generalized conservation laws of the lepton numbers are derived from the requirement of invariance under the gauge transformation involving the γ_5 matrix. The lepton processes, especially π-μ-e decay and β decay, are systematized by means of the conservation law. For the β decay process the two component theory of the neutrino is naturally derived. However this is not so in the problem of the μ-e decay. Various characteristics of these and other lepton processes are discussed in detail. (auth)

6329

BETA-GAMMA CORRELATION AND POLARIZATION OF PARTICLES IN THE BETA DECAY OF ORIENTED NUCLEI IN CONNECTION WITH PARITY NON-CONSERVATION. A. Z. Dolginov (Physico-Tech. Inst. of the USSR Academy of Sciences, Leningrad). Nuclear Phys. 5, 512-29(1958) Feb.

A formula for the angular distribution and polarization of β particles emitted by polarized or aligned nuclei is derived; the formula is valid for β transitions of any order of forbiddenness. The investigation is carried out for β interaction of a general form with possible parity non-conservation being taken into account. The β-γ angular and polarization correlation is determined. As a way of clarifying the problem of invariance of the theory under time reversal it is suggested that $\beta-\gamma$ correlation in allowed transitions of aligned nuclei be studied. It is taken into account in the calculations that the field inside the nucleus differs from that of a point charge. (auth)

6330

A POSSIBLE THEORY OF WEAK INTERACTIONS. R. Gatto (Univ. of California, Berkeley). Nuclear Phys. 5, 530-43(1958) Feb.

A discussion is given of some of the recent experimental results in β decay, and a possible theory of weak interactions is presented which is able to reproduce most of the results of the two-component theory but allows for the simultaneous presence of S and V in β interaction without violating time reversal. The theory is based on a generalization of Tiomno's mass reversal. (auth)

6331

FINITE SIZE EFFECTS ON M1 CONVERSION COEFFICIENTS. A. S. Reiner (Instituut voor Theoretische Physica, Amsterdam). Nuclear Phys. 5, 544-56(1958) Feb.

Finite size effects in M1 conversion coefficients are calculated using the collective model. For transitions within one rotational band corrections relative to Sliv's conversion coefficient can be as large as 50% in favorable cases. As an example of transitions between different rotational bands the 482 kev transition in Ta^{181} is discussed. The theory predicts a value of β(theoretical)/β(point-nucleus) ≈ 2, whereas the observed value is 5 ± 2. Corrections on static magnetic moments, as discussed by Bohr and Weisskopf, are estimated for elements in the same region. (auth)

6332

A GENERAL TREATMENT OF EXPANDING SYSTEMS. I. FORMULATION. Y. Takahashi and H. Umezawa (State Univ. of Iowa, Iowa City). Nuovo cimento (10) 6, 1324-34 (1957) Dec.

A general method of handling an expanding system is proposed from the field theoretical view point. It is shown that the canonical variables of a system S[V] enclosed in a volume V are connected by a unitary transformation with the canonical variables of a system S[V'] in a larger volume V'. The unitary transformation connecting these two systems is generated by the difference of the respective Hamiltonians. (auth)

6333

A GENERAL TREATMENT OF EXPANDING SYSTEMS. II. APPLICATION TO MULTIPLE MESON PROCESSES. Y. Takahashi and H. Umezawa (State Univ. of Iowa, Iowa City). Nuovo cimento (10) 6, 1382-91(1957) Dec.

The general theory proposed in the previous paper is applied to multiple meson processes. This is a field theoretical justification of the Landau theory of multiple meson production, based on a hydrodynamical analogy. According to calculation, mesons enclosed in a narrow disk will expand in the direction perpendicular to the disk and give a sharp angular distribution in favor of recent experimental data. (auth)

6334
APPROXIMATE THEORY OF FERRIMAGNETIC SPIN WAVES. T. A. Kaplan (Pennsylvania State Univ., University Park). Phys. Rev. 109, 782-7(1958) Feb. 1.

The wave functions and the energy spectrum for the spin-wave problem in a normal spinel are found by means of a straightforward extension of Anderson's approach to antiferromagnetism. Only A–B exchange is assumed to exist, and the calculation is carried to second order in the magnitude of the propagation vector, k. Five distinct energy surfaces (E vs k) are found, two of which are identical, in the classical limit, to the ones previously reported by H. Kaplan. Although the energy surfaces are all spherically symmetric, the wave functions depend in general on the direction of k. The error in a calculation by Vonsovski and Seidov, which led to a linear energy vs k relation for the lowest branch (as opposed to the quadratic relation found by H. Kaplan), is pointed out. (auth)

6335
STATISTICAL BROADENING OF SPECTRAL LINES EMITTED BY IONS IN A PLASMA. M. Lewis and H. Margenau (Yale Univ., New Haven, Conn.). Phys. Rev. 109, 842-5 (1958) Feb. 1.

The Holtsmark theory of line broadening omits the factor $e^{-V_{ij}/kT}$ in the evaluation of probabilities, V_{ij} being the Coulomb interaction between the ith and the jth ions. This leads to serious errors in the wings of a line where frequency shifts arise from close encounters which are inhibited by the Boltzmann factor. In part I of the present article a consistent binary approximation to the line shape is given, the assumption being made that only a single perturber is involved in a collision. Part II treats the case of many particles, retains V_{ij} for all perturbers j interacting with a single radiating ion i, but ignores forces between the perturbers themselves. Comparison is made with other treatments. (auth)

6336
FURRY'S THEOREM FOR VERY STRONG INTERACTIONS. Robert E. Pugh (Univ. of California, Berkeley). Phys. Rev. 109, 989-90(1958) Feb. 1.

An analogon to Furry's theorem is proved for Gell-Mann's "globally symmetric" model of very strong interactions. It is shown that the contribution corresponding to a diagram with an odd number of external pion lines and any number of external photon lines vanishes. (auth)

6337
SIGNIFICANCE OF THE REDUNDANT SOLUTIONS OF THE LOW-WICK EQUATION. Richard Norton and Abraham Klein (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 109, 991-5(1958) Feb. 1.

The content of the Low-Wick scattering formalism is studied, using the example of a class of exactly soluble meson theories with fixed-source interaction. The theories in question describe a set of harmonic oscillators with an arbitrary distribution of frequencies, coupled to a scalar meson field by means of their total dipole moment. The Low equation for scattering of a meson is shown to possess infinitely many solutions. These are compared with the exact, explicit solution of the same problem, and it is shown that there is a one-to-one correspondence between a particular choice of theory (number of oscillators and their frequencies) and a given one of the aforementioned solutions of the Low equation. A similar situation is shown to obtain for symmetric pseudoscalar theory, and it is made plausible thereby that Chew and Low have chosen the particular solution appropriate to their Hamiltonian. (auth)

6338
MESON PAIR THEORY IN INTERMEDIATE COUPLING. Richard J. Drachman (Columbia Univ., New York). Phys. Rev. 109, 996-8(1958) Feb. 1.

Wentzel's scalar meson pair theory has been treated in the intermediate coupling approximation, for two different forms of the cutoff function, and for various values of the coupling constant. The agreement of the approximate values of the self-energy with the exact ones is excellent. (auth)

6339
MASS-ENERGY RELATION IN QUANTUM THEORY. W. F. G. Swann (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 109, 998-1008(1958) Feb. 1.

It does not seem to be generally recognized that the mass-energy relation is not contained implicitly in the quantum theory, but is something superposed upon it, and without any clear guarantee as to its consistency with that theory. Even classical relativistic particle dynamics does not provide an explanation of "rest-mass defect." The first step in the paper is to produce a theory of rest-mass defects founded upon a concept in which a nucleon consists of a number of subparticles, or "specks" as they will be called, which specks obey conservation of relativistic energy and momentum in a suitably chosen frame of reference, and with rest masses which are regarded as absolute constants. The theory leads to a situation in which the nucleons act as individual entities conserving momentum as a whole but with rest masses which can vary with the mutual proximities of the nucleons one to another. However, in place of a corresponding conservation of kinetic energy, we have conservation of $\Sigma(\tau_n + m_{\phi n}c^2)$, where τ_n is the ordinary relativistic kinetic energy, so that $\tau_n = m_{\phi n}c^2[(1-\beta^2)^{-\frac{1}{2}} - 1]$. So far there is no mention of potential energy. However, at this stage we postulate that the $m_{\phi n}$ vary with the relative coordinates of the nucleons so that $m_{\phi n}c^2$ really becomes the representative of what is ordinarily regarded as a potential energy V. Indeed, $m_{\phi n}c^2$ becomes V + const. We thus arrive at $\tau_n + V = \text{const}$, but with the $m_{\phi n}$ occurring in τ_n being functions of relative coordinates. Normally, the next procedure would be to express τ_n in terms of the relativistic momentum, and then replace the momentum by the usual operator to form an equation for the ϕ function. A transformation to center-of-gravity coordinates and relative coordinates might be expected to lead to an expression for ψ of the form $\psi = \phi\chi$, where ϕ is a function only of the relative coordinates and χ is a function of the center-of-gravity coordinates. It might then be expected that the mass-energy relation could reveal itself in the fact that the equation for χ represented that of a single entity moving with constant velocity and with a rest mass $\Sigma m_{n\infty} - \epsilon_B/c^2$, where the $m_{n\infty}$ are the rest masses of the nucleon when at infinity, and ϵ_B is the binding energy which, in turn would be yielded by the ϕ equation, as the negative of the lowest eigenvalue for the energy in that equation. Realization of this form for the rest mass of the nucleus is the aim of the paper. The ϕ equation formed from the classical relativistic Hamiltonian in the above manner is of nonlinear form, and it resists an immediate accommodation of itself to the above procedure. However, by use, for the nucleus, of a "pseudomomentum" slightly different from the true relativistic momentum as the quantity which is to be replaced by the operator, and by a slight change in the manner of making the transformation to the operator form, the desired results are achieved. Both modifications of the normal procedure revert to that procedure for the case of small velocities. (auth)

6340
GROUND-STATE ENERGY AND STOPPING POWER OF AN ELECTRON GAS. Philippe Nozières and David Pines

(Laboratoire de Physique, Ecole Normale Supérieure, Paris). Phys. Rev. 109, 1009-10(1958) Feb. 1.

6341

AXIAL SYMMETRY OF NUCLEAR WAVE FUNCTIONS. R. K. Nesbet (Boston Univ., Mass.). Phys. Rev. 109, 1017-18(1958) Feb. 1.

6342

NUMERICAL DISCUSSIONS ON P-WAVE MESON-NUCLEON SCATTERING. Toshio Sawaguri (Metropolitan Univ., Tokyo) and Jun'ichi Osada (Tokyo Univ. of Education). Progr. Theoret. Phys. (Kyoto) 18, 91-3(1957) July.

6343

GRAVITATIONAL FIELD OF BIRKHOFF FOR A POINT MASS IN ARBITRARY MOTION IN THE BIRKHOFF THEORY. Carlos Graef Fernandez (Instituto de Fisica de la Universidad Nacional de México). Rev. mex. fís. 1, 11-27 (1952). (In Spanish)

The gravitational field of Birkhoff generated by a mass point in arbitrary motion is obtained. In the space-time of Minkowski this field is a doubly covariant tensor proportional to the mass that generates it. It is also proportional to a linear combination of the fundamental metric tensor and of the quadratic tensor in the covariant components of the retarded quadrivector velocity. It is inversely proportional to the distance from the event which was calculated in support of the retarded quadrivector velocity of the mass point with respect to this event. The field satisfies the fundamental Birkhoff equation since its D'Alembertian is null, and it reduces to the central field when the velocity is null. (tr-auth)

6344

VARIATIONAL PRINCIPLES FOR THE MOTION OF THE PLANETS IN THE CENTRAL FIELD OF BIRKHOFF. Carlos Graef Fernandez (Instituto de Fisica de la Universidad Nacional de México). Rev. mex. fís. 2, 180-92 (1953). (In Spanish)

It is shown that the trajectories of the planets in the theory of gravitation of Birkhoff are the extrema of a variational principle. There exists a Lagrangian for the motion of a planet around the sun. It may be seen that this Lagrangian is approximately equal to the Newtonian mechanics for the motion of the real planets around the real sun. It is also shown that the world lines of the planets in the Birkhoff theory are the extrema of a variational principle. (tr-auth)

6345

ON AN OPERATOR NEEDED IN THE BHABHA EQUATION. Fernando E. Prieto C. (Instituto de Física de la Universidad Nacional de Mexico e Instituto Nacional de la Investigación Cientifica). Rev. mex. fís. 3, 24-42(1954). (In Spanish)

An explicit form of the operator $p^2(p-\kappa)(p^2-a_1^2\ m_1^2)$, needed in the calculation of matrix elements for any process, and whose columns are free particle solutions of the equation $(p+\kappa)\ \psi = 0$, is given in this paper for the case of Bhabha equation. (auth)

6346

TRANSITORY EFFECTS OF THE PENETRATION OF A POTENTIAL BARRIER. Juan Manuel Lozano (Instituto de Física de la Universidad Nacional de México e Instituto Nacional de la Investigación Científica). Rev. mex. fís. 3, 63-75(1954). (In Spanish)

The transitory effects of the penetration of a potential barrier are calculated, and the results are used to interpret the transitory effects of scattering by a potential which were previously calculated. (tr-auth)

6347

SCATTERING OF ELECTRONS BY MESONS. Juan de Oyarzabal (Instituto de Física de la Universidad Nacional de México e Instituto Nacional de la Investigación Científica). Rev. mex. fís. 3, 76-83(1954). (In Spanish)

The second order interaction between the electron and meson fields, coupled by an electromagnetic field, was calculated, concluding with the differential and total cross sections and the angular distribution for the process of scattering pions by electrons and vice versa. (tr-auth)

6348

DIFFRACTION IN TIME ASSOCIATED WITH A SOURCE DISTRIBUTION. Marcos Moshinsky (Institutos de Física y de Geofísica, Universidad Nacional de Mexico e Instituto Nacional de la Investigación Científica). Rev. mex. fís. 3, 236-52(1954). (In Spanish)

It is shown that problems of diffraction in time associated with the opening and closing of a shutter, can be described in terms of a source distribution in the region occupied by the shutter. In this way, the equivalence between this approach to the problems of diffraction in time and the one suggested recently by O. Costa de Beuregard following the ideas of Fresnel with respect to ordinary diffraction is shown. In particular, the problems of diffraction in time for relativistic particles are studied, and an interpretation of the positive and negative energy terms that appear in the analysis is given. (auth)

6349

MOTION OF A MASS WHICH ANNIHILATES ITS OWN GRAVITATIONAL FIELD. Carlos Graef Fernández (Instituto de Física de la Universidad Nacional de México). Rev. mex. fís. 3, 253-67(1954). (In Spanish)

It is shown that it is possible to move a mass point of mass as large as desired – so that an exploring particle does not feel it gravitationally. The exploring particle is initially at rest in an inertial system. The mass point begins its motion with the velocity of light, starting from the exploring particle and describing a straight line. The velocity of the mass point diminishes gradually to zero; immediately the mass point retraces its steps, but not symmetrically. Its velocity increases gradually until reaching its limiting value: the velocity of light. During all this motion – or during any part of it – the mass point did not produce any acceleration in the exploring particle. (tr-auth)

6350

PROBABILITY SPACES IN QUANTUM MECHANICS. I. Alejandro Medina (Instituto Nacional de la Investigación Científica). Rev. mex. fís. 5, 53-67(1957). (In Spanish)

An analysis of some of the fundamental principles underlaying the construction of operators in quantum mechanics is given. Each operator is associated to a projection operator and these projection operators are shown to fulfill a set of properties formally identical to those of a probability field. It is shown that, by the introduction of a measure in configuration space it is possible to obtain complete sets of commuting observables having, within limits, preassigned spectra. The introduction of new operators by consideration of the groups expressing the symmetries of the system, is discussed. (auth)

6351

ENERGY LEVEL SHIFT OF SPIN ½ PARTICLES IN A COULOMB FIELD. G. A. Zaitsev. Soviet Phys. (Doklady) 2, 214-16(1957) May-June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10790.

6352

ON ALLOWED TRANSFORMATIONS OF THE EQUATIONS FOR PARTICLES WITH HIGHER SPINS. E. E. Fradkin

and S. V. Izmailov (A. I. Herzen Leningrad State Pedagogical Inst.). Soviet Phys. (Doklady) 2, 232-6(1957) May-June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10791.

6353

THE RELATIVISTIC COLLISION INTEGRAL. N. A. Chernikov (Joint Inst. for Nuclear Research). Soviet Phys. (Doklady) 2, 248-50(1957) May-June.

The relativistic Boltzmann collision integral which describes the collisions between an irradiating particle and the particles of the irradiated substance are derived. It is assumed that only two-particle collisions are of importance and that external forces do not affect the collision. (J.S.R.)

6354

CONTRIBUTION TO THE THEORY OF TRANSITION RADIATION. G. M. Garibyan (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 1403-10(1957) Dec.

Transition and Cherenkov radiation arising when a charged particle moves in succession through two media differing in respect to dielectric and magnetic properties are considered. The cases when the particle enters the medium from vacuum or vacuum from the medium are discussed in detail. (tr-auth)

6355

DETERMINATION OF THE PHASE SHIFTS OF THE MATRIX ELEMENTS OF THE S-MATRIX. V. N. Gribov (Leningrad Inst. of Technical Physics). Zhur. Eksptl'. i Teoret. Fiz. 33, 1431-6(1957) Dec. (In Russian)

For reactions involving two or three channels or reactions of formation of three low energy particles it is shown how the phase shifts of the S-matrix elements can be expressed in terms of measurable quantities by making use of unitarity of the S matrix and invariance of the theory with respect to time inversal. The reactions $\pi^+ \rightarrow 2\pi^+ + \pi^-$ and $p + p \rightarrow D + \pi^+$ are considered. (tr-auth)

6356

THE SUM OVER TRAJECTORIES FOR DIRAC EQUATION. G. V. Ryazanov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1437-44(1957) Dec. (In Russian)

It is shown that under some assumptions concerning the motion of an electron, the Feynman sum over trajectories is identical with the propagation function of the Dirac equation. (tr-auth)

6357

RELATION BETWEEN DECAY ASYMMETRY AND THE DIPOLE MOMENT OF FUNDAMENTAL PARTICLES. Ya. B. Zeldovich. Zhur. Eksptl'. i Teoret. Fiz. 33, 1488-96(1957) Dec. (In Russian)

Proceeding from a simple model of emission of nonrelativistic particles, the wave function of a system is constructed in the coordinate representation for cases of real decay and virtual decay. It is shown that the asymmetry of real decay of a polarized particle depends on the imaginary part of the gradient coupling constant, while the asymmetry of virtual decay and the dipole moment depend on the real part of this constant. Fundamental particles which, in accord with Landau, do not possess a dipole moment, are shown to be similar to enanthiomorphic (optically active) molecules in the A-doubled states. A consistent description of particle production is developed in the coordinate representation. A convenient expression for the probability of virtual decay is presented. (tr-auth)

Uranium and Uranium Compounds

6358 DP-230

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

KINETICS OF THE BETA TRANSFORMATION OF URANIUM. William R. McDonell. Sept. 1957. Decl. Dec. 5, 1957. 20p. Contract AT(07-2)-1. $3.30(ph OTS); $2.40 (mf OTS).

When U is heat treated at low beta-phase temperatures and air cooled, the rate of loss of preferred orientation is markedly less than the rate of coarsening of the grain structure. A coarse-grained structure cannot therefore be taken as an infallible indication of satisfactory heat treatment. The final grain size of incompletely transformed metal is essentially equal to or larger than the starting grain size. Large-grained specimens can not be refined by interruption of the transformation at an intermediate stage. (auth)

6359 HW-53356

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ANNEALING STUDIES ON IRRADIATED URANIUM. Interim Report. W. S. Kelly. Nov. 1, 1957. Decl. Feb. 25, 1958. 22p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Results of the annealing studies indicate that the hardness values of irradiated U combined with metallographic examination make it possible to determine if the temperature of irradiation was within certain temperature zones. These zones are 800°C or above, 700 to 800°C, 600 to 700°C, and 400 to 600°C. The tests were conducted on material of less than 0.1 at. % burnup of U^{235}, with the major portion having a burnup of 0.097 at. %. Results of density determinations before and after gamma phase annealing revealed a maximum decrease in density of 1.2% for a sample of 0.097 at. % burnup. Attempts to produce gas voids in U by post-irradiation annealing into the gamma phase have met with limited success, though voids visible at 300 X have been observed in U irradiated at gamma phase temperatures. Tensile test results indicate that the rate of heating and cooling above 600°C, when annealing in the beta or gamma phase temperature region, has a decided effect on the degree of recovery of the uranium. Slower heating and cooling rates resulted in greater recovery of irradiation damage, as evidenced by increased ductility and decreased yield strength. (auth)

6360 WIN-82

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH RESIN-IN-PULP PILOT PLANT TESTING OF URANIUM REDUCTION BLEND. H. E. Gardner, M. A. Peters, Guy Winslow, and R. L. Shimmin. Jan. 15, 1958. 58p. Contract AT(49-6)-924. $9.30(ph OTS); $3.60(mf OTS).

A blend of uranium ores was treated in the Alkaline Leach–RIP Pilot Plant at Grand Junction, Colorado. Detailed information is presented on grinding, leaching, reagent recovery, sand-slime separation, ion exchange, and precipitation as related to the processing of this ore. Autoclave leaching was employed and results show the ore to be amenable to the Alkaline–RIP process. (auth)

6361

THE NEUTRON TOTAL CROSS-SECTIONS OF URANIUM-234 AND URANIUM-236. G. J. McCallum (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy 6, 181-90(1958).

The neutron total cross sections of U^{234} and U^{236} have been measured as a function of energy between 0.01 ev and 20 ev. The absorption and total scattering cross sections at 2200 m/sec are deduced, and the parameters of the first resonance in each isotope calculated. (auth)

6362

TEN-GROUP CALCULATED EQUILIBRIUM NEUTRON SPECTRUM AND DIFFUSION LENGTH IN NATURAL URANIUM. D. Meneghetti, H. H. Hummel, and W. B. Loewenstein (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 151-60(1958) Feb.

The degradation of neutron energies in a fast reactor is largely due to inelastic scattering. In a dilute fast system (large U^{238} to U^{235} atomic ratio) the neutron spectrum is then primarily determined by a fission spectrum distribution modified by inelastic scattering in U^{238}. In this investigation a set of ten-group fast cross sections for U^{238} have been prepared with the inelastic cross sections below about 1.35 Mev based upon levels at 45, 150, and 700 kev. The inelastic transfer contributions from unknown higher levels were chosen to be consistent with the gross measurements of Bethe, Beyster, and Carter, having the three-group energy division consisting of above 1.4 Mev between 0.4 and 1.4 Mev, and below 0.4 Mev. The ten-group fast cross sections were tested by comparing the calculated equilibrium spectrum, diffusion length, and detector responses in natural uranium with reported experimental values found in the blanket of the Zephyr reactor and in the Snell experiments. (auth)

6363

THE LUMINESCENCE OF TRIVALENT URANIUM. L. N. Galkin and P. P. Feofilov. Soviet Phys. (Doklady) 2, 255-7(1957) May-June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 12311.

6364

ANGULAR CORRELATION BETWEEN THE FRAGMENTS AND CHARGED PARTICLES EMITTED IN THE FISSION OF URANIUM NUCLEI. V. I. Ostroumov and R. A. Filov (Leningrad Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1335-40(1957) Dec. (In Russian)

Fission events induced by 660-Mev protons in uranium nuclei and involving the emission of charged particles were observed in emulsions. The angular distribution of these particles relative to the direction of the bombarding beam and also relative to the line of flight of the fragments was measured. No angular correlation between the protons and fragments was found although some of the protons may have been emitted by the fission fragments. Alpha particles and multicharged particles exhibit a tendency to be emitted at large angles with respect to the fragments. Factors which may be responsible for the observed correlation between α particles and fragments are discussed. (auth)

PATENTS

Chemistry

6365

EXTRACTION OF URANIUM COMPOUNDS. T. V. Arden, F. H. Burstall, and K. P. Linstead. British Patent 781,721. Nuclear Eng. 3, No. 23, 90(1958) Feb.

Solvents containing the furane nucleus, especially hydrocarbon substituted tetrahydrofurane, have been found to give high extractions of uranyl nitrate from aqueous solutions.

6366

PROCESS FOR REMOVAL OF CATIONS FROM AQUEOUS SOLUTION. E. Gleuckauf and P. J. O. Roberts (to U. K. Atomic Energy Authority). British Patent 781,726. Nuclear Eng. 3, No. 23, 90(1958) Feb.

The aqueous solution containing cations is brought into contact with a solid anion exchange substance, insoluble in water and having, at the exchange positions, anions which will form insoluble compounds with the cations. All metal ions except those of alkali metals may be precipitated. These cations may also be separated from each other, or from those of the alkali metals. The precipitate formed on the anion exchange substance may be removed by washing with a suitable aqueous acid or complexing agent. Anions mentioned are hydroxide, carbonate, sulfide, or chromate.

6367

PRODUCTION OF N-SUBSTITUTED o-DIAMINES. E. S. Lane and C. Williams (to U. K. Atomic Energy Authority). British Patent 781,790. Nuclear Eng. 3, No. 23, 90(1958) Feb.

An N-aryl-o-diamine is prepared by a method in which an aryl-lithium compound is reacted with a benzo 2:1:3 thiadiazole or selenium or oxygen analog thereof.

6368

PREPARATION OF THE HEXAFLUORIDES OF URANIUM AND PLUTONIUM. C. J. Mandleberg, R. Hurst, and H. K. Rae (to U. K. Atomic Energy Authority). British Patent 782,982. Nuclear Eng. 3, No. 23, 90(1958) Feb.

Elemental fluorine is reacted with an oxide of uranium or with an oxide or the trifluoride of plutonium at a temperature in the range of 550 to 650°C.

6369

IMPROVEMENTS IN OR RELATING TO PRODUCTION OF RADIOISOTOPES. J. C. Charlton and C. C. Evans (to United Kingdom Atomic Energy Authority). British Patent 784,125. Sept. 28, 1955. Nuclear Power 3, 44(1958) Jan.

Carbon 14 is prepared by neutron irradiation of nitrogen compounds—calcium, ammonium, and potassium nitrates have been used. Previous method of recovery was by bringing the nitrate into aqueous solution and acidifying it to release carbon dioxide and monoxide, which were then absorbed in caustic alkali. In the method described in this paptent, an irradiated nitride—preferably finely divided aluminum nitride—is slowly oxidized at 900°C by a stream of oxygen, and the resultant gases passed through a train of bubblers containing aqueous alkali metal hydroxide solution to absorb the radioactive carbon dioxide formed.

Engineering

6370

APPARATUS FOR USE IN WELDING CONCENTRIC PIPE ASSEMBLIES. C. T. L. O'Grady (to U. K. Atomic Energy Authority). British Patent 781,317. Nuclear Eng. 3, No. 23, 90(1958) Feb.

After welding the inner pipe, which is arranged to stick out over the outer pipe by 4 in. so that the weld is easily made, units of sector-shaped pads with flexible edges are inserted in the space between inner and outer pipes, each unit forming, with the walls, a sector of an annular cavity. Gas (argon) is fed into the cavity through an arcuate perforated tube to set up a gas purge, to be discharged through another tube while the outer weld is being made.

6371

GO-DEVILS. S. Jefferson (to U. K. Atomic Energy Authority). British Patent 781,775. Nuclear Eng. 3, No. 23, 90(1958) Feb.

In order to find the position of go-devils jammed in a pipeline, a source of radioactivity may be incorporated or attached so that the go-devil may be found by a detector of radioactivity even under several feet of earth. However, an unshielded source may be dangerous where remote handling for freeing the go-devil is not possible. The pressure-sensitive arrangement of a screening pot, e.g., a lead cylinder with a small axial bore, on the holder for the radioactive source which is withdrawn from the source at the operating pressure in the pipeline but goes into screening position at atmospheric pressure, will protect persons when freeing the go-devil, e.g., by cutting the pipeline.

6372

INSPECTION METHOD AND APPARATUS. M. Middleton, W. F. Stevenson, and D. B. Smith (to Rolls-Royce Ltd., U. K. Atomic Energy Authority). British Patent 782,752. Nuclear Eng. 3, No. 23, 90(1958) Feb.

The detection of cracks or flaws in flexible hoses, e.g., made by bonding rubber on canvas (for hydraulic and fuel systems), is described. The hose is first subjected under pressure to a liquid including a radioactive isotope in solution. The liquid is then removed and the hose examined by a device for sensing radioactivity. (Geiger-Mueller tubes). Where radioactive liquid is occluded a normal radioactivity will be sensed. The radioactive isotope recommended is cerium 144-praseodymium 144.

6373

REMOVAL OF HEAT EXCHANGE MEDIUM FROM HEAT EXCHANGE SYSTEMS. A. Bell (to Foster Wheeler Ltd.). British Patent 782, 943. Nuclear Eng. 3, No. 23, 90(1958) Feb.

The removal of residual metal from systems in which, e.g., sodium or a sodium/potassium alloy is circulated as heat exchange medium is discussed. When the bulk of the metal has been drained off (after a shutdown of the system) small amounts of metal will be left in pockets and crevices. The system is freed from these last traces by passing dry ... heated steam under low pressure through the circuit while maintaining the temperature above the melting point of the metal and above the condensation temperature of the steam. The steam reacts with the metal to form hydrogen (vented out) and metallic oxide to be dissolved in and washed out by water.

6374

IMPROVEMENTS IN OR RELATING TO PRESSURE VESSELS. R. N. Millar and K. J. Mitchell (to the General Electric Co., Ltd.). British Patent 785,945. May 31, 1955. Nuclear Power 3, 92(1958) Feb.

One design difficulty of the British type of gas-cooled reactor is in the design of the pressure vessel to withstand the pressure and heat for many years of continuous operation. Taken out by GEC's nuclear chief, R. N. Millar, and a colleague this patent shows how it is being tackled at the firm's Hunterston station. Briefly, the idea is to use two shells—one to withstand heat but little pressure, the other for pressure only. Five different forms of construction are described in the specification. Some fresh coolant gas is bypassed and distributed round the top part of the outer sphere and allowed to leak into the inner shell. By this type of construction, the outer shell can be ordinary boiler plate while the inner shell can be in relatively thin heat-resisting steel.

Mineralogy, Metallurgy, and Ceramics

6375

PRODUCTION OF BERYLLIUM. L. J. Derham (to National Smelting Co., Ldt.). British Patent 781,100. Nuclear Eng. 3, No. 23, 90(1958) Feb.

Beryllium fluoride and magnesium in admixture are compacted and charged into a body of molten calcium chloride. The mass is then heated in a sealed vessel to a temperature above the melting point of beryllium.

6376

PROCESS FOR COATING METALS. R. L. Samuel (to Diffusion Alloys Ltd.). British Patent 781,594. Nuclear Eng. 3, No. 23, 90(1958) Feb.

The metal is first coated with a liquid or pasty composition containing chromium or chromium alloy in powder form, together with a carrier which is solid at room temperature but liquid at the operating temperature (a halide other than chromium halide). The coated metal is then heated by a high-frequency current. A bonding agent (organic silicate) may be present.

6377

HEAT TREATMENT OF TITANIUM ALLOYS. (To Armour Research Foundation of Illinois Institute of Technology (U. S. A.)). British Patent 782,148. Nuclear Eng. 3, No. 23, 90(1958) Feb.

A stable titanium base alloy for use at high temperatures containing 2 to 8% aluminum, 1 to 6% molybdenum (aluminum at least twice molybdenum content) has been held at 1,500 to 1,650°F for 4 to 24 hours to coarsen the microstructure to form a continuous alpha phase. This is quickly cooled, then aged at 1,000 to 1,200°F for 4 to 48 hours, until the beta phase becomes "dark etching." The treatment counteracts the tendency towards embrittlement.

6378

CERAMIC SUBSTANCES DERIVED FROM CHROMIUM SESQUIOXIDE. British Patent 782,997. Nuclear Eng. 3, No. 23, 90(1958) Feb.

An intimate mixture of finely divided chromium sesquioxide and metal powder is heated to a temperature of 1500 to 1800°C in an inert atmosphere. The metal powder is employed in amount to give a product wherein the ratio Cr : O is 1 to 1.2 to 1.4. The product sinters at elevated temperatures and may be compacted (cold or hot pressing, sintering) with or without a cementing metal or by bonding with organic resin. The material is of great hardness (for cutting tools or high temperature use under oxidizing conditions).

Physics

6379

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. S. G. Bauer (to United Kingdom Atomic Energy Authority). British Patent 771,111. Oct. 19, 1946. Nuclear Power 3, 44(1958) Jan.

Originally filed over ten years ago, and now presumably only of academic interest, this patent concerns a reactor in which the fissionable material is in the form of extended films or layers sandwiched between plates of moderator material. It may also comprise sandwiches of fertile material for breeder reactors, and also of neutron absorber for control.

6380

NUCLEAR REACTOR. R. V. Moore, K. H. Dent, and J. H. Bowen (to U. K. Atomic Energy Authority). British Patent 781,648. Nuclear Eng. 3, No. 23, 90(1958) Feb.

A natural uranium-fueled reactor for the economic generation of electricity is given. The moderator structure inside the pressure vessels is formed with vertical fuel elements in channels symmetrically arranged on a regular lattice in groups. Control-rod channels are also arranged on a regular lattice each centered on one of the groups. A coolant circuit is connected with the pressure vessel above and below the moderator structure. Through the shielding

around the pressure vessel and through the vessel extend control-rod channels with a control-rod driving mechanism surmounting shielding plugs in access holes vertically above the channels. For fuel charging, chutes are introduced into the access holes. The vertical orientation has a number of advantages regarding support of the structure, arrangement of control rods (falling by gravity on failure of the mechanism), operating space, and shielding.

6381

MODERATOR AND REFLECTOR STRUCTURES FOR NUCLEAR REACTORS. E. Long and F. G. Greenhalgh (to U. K. Atomic Energy Authority). British Patent 782, 922. Nuclear Eng. 3, No. 23, 90(1958) Feb.

A series of elastic bands built up of joined links is arranged around the structure. Each link consists of a nest of coaxial tubes, every second tube being provided with an exterior flange at one end and an interior flange at the other end, between which is mounted a flangeless tube. The tubes are then alternately under equal tension (flanged) and equal compression (flangeless), and the tension in the bands is transmitted as a centripetal load to the walls of the moderator and reflector structure.

6382

IMPROVEMENTS IN OR RELATING TO SUPPORT DEVICES FOR USE IN NUCLEAR REACTORS. F. C. Greenhalgh and E. Long (to United Kingdom Atomic Energy Authority). British Patent 783,094. July 28, 1954. Nuclear Power 3, 92(1958) Feb.

Another Calder patent, this deals with the method of supporting the stack of fuel elements to allow for differential expansion between the base support members and the moderator. It also provides a shear pin and broach device at the bottom of the column so that the accidental dropping of a fuel element on to the column does not cause permanent damage. The assembly also includes an annular plate, known as the gag, by means of which the amount of coolant entering the particular channel can be regulated.

6383

NEUTRON WELL LOGGING APPARATUS. (To Schlumberger Well Surveying Corp.) British Patent 784,641. Dec. 20, 1954. Nuclear Power 3, 92(1958) Feb.

Desirable qualities for a source of neutrons to be used in well-logging operations are: a high-level, controllable flux of monoenergetic neutrons with means of stopping it when not required. Schlumberger's latest patent claims to provide this in the space necessary to permit entry into a borehole. As described, the reaction envisaged is the D-T process, accelerated deuterium ions being used to bombard a lithium target hydrided with tritium.

6384

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. K. H. Dent (to United Kingdom Atomic Energy Authority). British Patent 784,890. Aug. 25, 1955. Nuclear Power 3, 92(1958) Feb.

At one time it was proposed to use separate supports for the Calder Hall fuel elements and this patent covers the idea. The idea was to attach a spider with three hinged legs to the top of each fuel cartridge. The legs were spring-loaded outwards and located in circumferential grooves cut in the graphite blocks. Since neutron economy is so important, these spiders would have to be in beryllium or zirconium. A beryllium one was illustrated at the BNEC's Calder Hall symposium.

6385

IMPROVEMENTS IN NUCLEAR REACTORS INCLUDING HORIZONTAL GRAPHITE BARS. (to Commissariat a l'Energie Atomique, Paris). British Patent 785,928. June 14, 1957. Nuclear Power 3, 44(1958) Jan.

Evidently referring to GI reactor at Marcoule, the specification covers resilient means for supporting the core. The patent is a complicated one not easily summarized but some points are made clear by a diagram.

6386

IMPROVEMENTS IN DEVICES FOR DISCHARGING RODS OF FISSIONABLE MATERIAL FROM NUCLEAR REACTORS. Sebastien Foglia (to Commissariat a l'Energie Atomique, Paris). British Patent 787,971. June 16, 1956. Nuclear Power 3, 92(1958) Feb.

In the big new French gas-cooled piles, the fuel channels are horizontal and elements are discharged simply by pushing in a new one at the charge face. The problem is to take care of the hot element and prevent it becoming broken. According to the invention, on leaving the channel it is turned through a right angle in a sloping chute and then conveyed to a cylindrical duct fitted with an internal helical chute. In this a relatively low terminal velocity is achieved and the slug then emerges to another spiral chute in which it is further slowed down. It is finally dumped into a sand-filled truck running in a tunnel through the biological shield.